

Why do farmers plant trees? Developing and testing a decision-making model for Indonesian farmers

**A thesis submitted in partial fulfilment of the requirements for the degree of
Doctor of Philosophy**

**By
Didy Wurjanto**

**School of Forestry
University of Canterbury
Christchurch, New Zealand
2001**

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Abstract

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The main issue faced by the Government of Indonesia (GoI) in managing its tropical forest resources is the uncontrolled forest degradation that has reached an alarming rate. This problem particularly has adversely affected the balance of wood supply and demand in Indonesia as well as creating some environmental issues. The GoI has sought to maintain and to rehabilitate its natural forest by introducing various policies and programmes. One of these programmes is to create new resources through encouraging landowners to grow trees for timber production.

A case study using multiple social science methods was conducted in Riau Province of Indonesia with the objective of understanding landowners' reasons, aspirations and decision-making regarding tree planting. Understanding these topics is very important for planning and implementing further policies and projects relating to tree planting on private land for timber production. To date, only a few studies of landowners' decision-making regarding tree planting have been conducted in Indonesia. The research used unstructured interviews to identify the tree planting issues directly from the landowners themselves. Primary data and information obtained from the 146 farmers and landowners were then arranged into a hierarchical decision model (HDM) in order to examine and to understand decision-making. The tree-like model formulated in this study represents details of the landowners' decision-making process and explains why they decided to plant or not to plant trees on their lands. The model does not simply list the factors influencing the farmers' decision-making, nor only presents the main reasons and constraints that the landowners took into account before they decided to grow trees, but also provides details about the process of their decision-making.

The decision model was then tested to evaluate how well it predicted behaviour. The testing procedure used a questionnaire survey that involved a sample of 309 randomly selected respondents in the same study area. The survey was conducted with the help of the survey helpers, and the questions in the questionnaire were based on the decision criteria that represent the model. The results show that the model was able to predict decision-making behaviour with a reasonable accuracy of 82 percent. In addition the research used statistical tests to analyse quantitative data obtained from the model-testing period. Both qualitative and quantitative results were then compared, and the results obtained from quantitative analysis supported and strengthened the findings obtained from the decision tree model. The combination of results from the qualitative and quantitative approaches has increased understanding of tree planting decision-making.

The hierarchical decision tree model is one of the cognitive science models which has worked well in representing farmers' decision-making in the study area, and was a suitable approach to address the objectives of this research. Different from similar research that highlights only the significant factors influencing farmers' decision-making, the HDM model in this thesis showed that farmers responded to distinctive combinations of economic and social factors in making decisions regarding tree planting. The model also showed the details of the decision-making process that it is not possible to represent with economic models or statistic behaviour models.

Based on real-life decision-making, the model in this research is able to show the needs as well as the aspirations of landowners and farmers regarding tree planting. The model is useful to policy makers, and shows that farmers had views and expectations different from the Indonesian government. The current policies provided by the GoI are not sufficient to encourage farmers to manage trees on their own farms. In order to have more farmers or landowners participate in the tree-planting programme, the model suggests that the Indonesian government should adjust and improve the implementation of the policies in line with the needs of people who are involved in the programme. The recommended policies include providing channels for small-scale tree farmers, improving the way the GoI trains the extension agents, continue providing incentives and soft loans with more emphasis on helping small tree farmers. It also includes giving usufruct rights to tree farmers, and introducing inter cropping systems rather than monoculture tree plantation. Decentralisation strategies can also be effective to conserve and to utilise community based forest management.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

The Indonesian Government considers forest a natural resource upon which many people rely heavily and the current policy is that it should be wisely utilised under government supervision for the optimum welfare of the Indonesian people. The Government of Indonesia, through the Ministry of Forestry (the MoF), controls nearly all forestlands. However, the uncontrolled deforestation that led to wood supply deficit and environmental problems has reached an alarming rate, and this situation proved the government's inability to manage Indonesian forest resources on its own. As a result, among other ways to remedy this current problem, as well as to actuate its commitment to provide a better life for rural areas, the MoF persuades and encourages rural communities and individual landowners to create new resources by planting trees on their own lands.

Coinciding with the economic crisis that has affected Indonesia since 1998, and realising the government's mistakes with its economic policy, the MoF has changed its main policy from economic and revenue orientation to managing the forest resources for the welfare of the Indonesian people, economically and socially. Consequently, the MoF has put more emphasis on programmes or activities that relate to community involvement. However, the success of this new approach depends heavily upon whether rural dwellers or landowners are willing to get involved with forestry programmes that encourage tree planting on private lands. Learning from other countries' experiences, this research takes as its main assumption that the Indonesian government will not be able to implement such programmes successfully without understanding the needs of those involved.

Understanding people's needs means their reasons for participating in the programme should be identified first. Such reasons might include price or market opportunities, government policies, cultural tradition, or land and labour availability. Therefore this research intends to assist the MoF by presenting information on why people plant or do not plant trees on their own lands.

Using social research methods, this research has developed a decision-making model that precisely identified reasons and constraints of landowners regarding planting trees in the study area that are specific to social, political and economic conditions of the study area. The use of social science methods that are not often used in forestry research, and the unique findings stemming from the application of these methods, enable this research to make an important contribution to forestry management.

This thesis is presented in five chapters. Following this introductory chapter, chapter two reviews factors influencing the farmers' decision-making to plant or not to plant trees, and the methods that examine those factors. Chapter three presents the methods used by this thesis, which covers fieldwork activities and data collection. Chapter four presents the results of this research, and chapter five discusses the findings, and draws conclusions.

1.2 Background of the Study

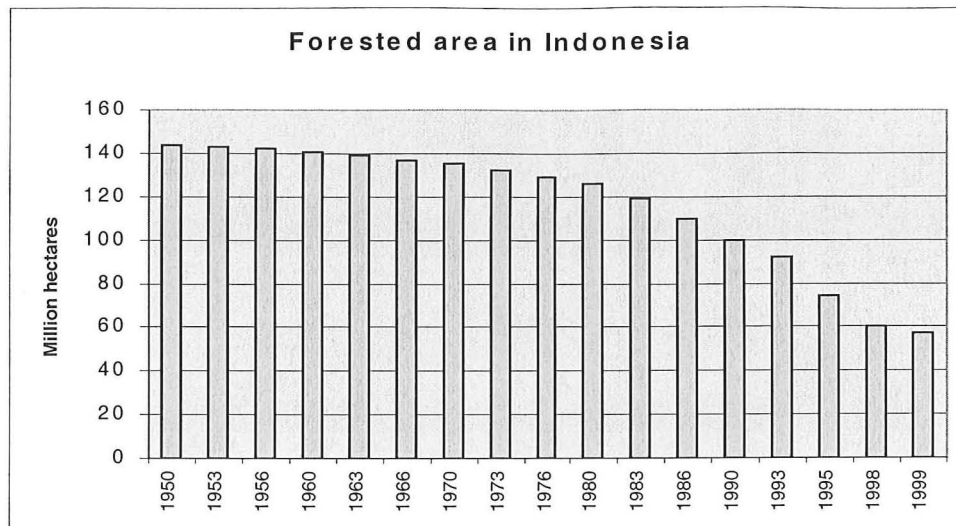
Indonesia, like many other countries, needs revenue to stimulate national economic growth. As a result, political leaders and economists directed forestry institutions to adopt forest exploitation policies that accelerated forest degradation and caused environmental problems. Uncontrolled forest use has led also to a wood supply deficit. In response, the Indonesian government has called for replanting efforts. As time proved that the government alone was incapable of adequately carrying out the replanting tasks, or of easing the rapid forest depletion, the Indonesia foresters asked local people that previously were denied access to forests to assist them with forest plantation and protection.

Indonesian forests are approximately 40 percent of the total tropical forests in Asia or six percent of the remaining tropical forests in the world (Sunderlin and Resosudarmo, 1997) that can be considered as international public goods or as lungs of the world. The development of international timber markets, more advanced harvesting technologies, and government needs for revenue generation led forest agencies to adopt forest exploitation policies (Poffenberger, 1990). Indonesian forest exploitation worsened owing to private-sector interests, politicians needing funds to support their bureaucratic machines or stabilise their regimes, and foreign and national entrepreneurs wanting quick profits. The alarming rate of deforestation approximately 1.3 million ha per annum (Sunderlin and Resosudarmo, 1997), has led to a rapid loss in forest area from 144 million hectares in the 1960s to 112.3 million hectares in 2000 (see Table 1 and Figure 1). According to aerial photography, the forest cover in Indonesia in 1993 was only 97.4 million hectares (Hassanudin, 1996). The implementation of forestry policies to introduce sustainable-yield logging practices, a lack of incentives and low salaries of forestry officials as well as limited monitoring capacity, led to corruption that permitted over-cutting and consequently left permanent degradation of many leased areas. Throughout the provinces, logging roads have opened up access to the forests, making them accessible to people who clear the remaining vegetation through slash-and-burn practice, further denuding the land. Charlie (2001) argued that this deforestation acceleration is likely to worsen since the economic crisis hit Indonesia in 1998.

Table 1: Forest Areas in Indonesia and Their Functions.

Forest functions	Area (Ha)	%
Protection forests	33,519,600	30.0
National parks & wildlife reserves	20,500,988	18.5
Limited production forests	23,057,449	20.5
Production forests	35,197,010	31.0
Total forest areas	112,275,047	100

(Source: The Ministry of Agriculture and Forestry, 2000)

**Figure 1: Forested area in Indonesia (source FAO, 2000)**

One of the main problems that Indonesian forestry has to face is an unbalanced supply and demand for wood. The average annual wood demand in Indonesia is 40.7 million m³ annum⁻¹ while the wood supply estimation is only 33.9 million m³ (MoF, 2000). The MoF also estimates the wood deficit to have been 29.8 million m³ annually since 1995. To anticipate the wood supply and demand situation, the establishment of large-scale industrial forest plantations (Hutan Tanaman Industri /HTI) has been a policy goal of government since 1984. The aim of this programme was to turn degraded forest areas into a valuable resource, and enhance the market for timber, pulp and paper and reduce pressure on natural forests (Anwar, 1993). But the establishment of HTIs has been slow and the ambitious plans commencing in 1984 to plant 1.5 million ha every five years and establish 4.5 million ha of plantations by 2000 have not been achieved (MoF, 1995, MoF, 2000). The MoF (2000) claimed that the HTI establishment has achieved 1.4 million ha in 2000 or only 31 percent of the target. However, Simon (1995) argued that the success rate of the HTI is far under the planted areas.

The unstable and low prices of pulp and paper, lack of processing facilities and high costs for their establishment were the constraints for private owners to establish the plantations. Similarly, unreliable government incentives, particularly access to the reforestation fund and lack of adequately sized land parcels, limited the plantation programme (World Bank, 1995; Potter and Lee, 1998). To overcome problems with land and labour costs, some HTI companies have begun implementation of a community forestry (*Hutan Rakyat*) programme where a group of farmers pool at least 50 ha of their private land and grow preferred trees for the companies. The companies and farmers share all inputs and the eventual fund in the form of a partnership system. Realising local community potential, the government is facilitating this system and targeting 366,000 hectares of privately owned lands, and 6,131,900 hectares of bare lands outside state forest areas. Toward the year 2004, the government expects to establish 250,000 hectares would enable them to produce 43 million m³ or 8.7 million m³ annually (MoF, 1995).

Traditional forest management maintained exclusive control and barred local people from the forest resources. Some authors argued that excluding local people from Indonesian forest management is a fundamentally flawed colonial legacy that has contributed to the current forest degradation crisis (Peluso et al., 1994; Wiersum, 1999; Poffenberger, 2000). The centralised management and top-down approaches inherited from the past are also considered impediments which ignore the aspirations and needs of local people in this partnership system. In this case, the local communities are still treated as an object. As a result, there is evidence that these partnership efforts and government intervention in encouraging tree growing on private lands are still far from achieving the expected targets (Hardjanto and Kusnanto, 1995; Simon, 1995; MoF, 1998). The government had not yet seriously given the opportunity to local communities to be partners in the forest management system. However, since the resignation of President Soeharto in 1998 following the economic crisis that had been affecting Indonesia, a reform movement that forced Soeharto to step down from power, also demanded restructuring all aspects in the government. As a result, the MoF through its policies has given more attention to local community participation in Indonesian forest management. Aided by the realisation that the past Indonesian forestry policy has failed to meet the sustainable forest management criteria, the reform movement has driven the emergence of a community-based forest management paradigm which is a new approach in the history of forest management in Indonesia.

1.3 History of Indonesian Forest Management

Indonesia is an immense archipelago extending over 4,500 kilometres from the Indian Ocean to the Pacific. With some 13,000 islands, the nation possesses the world's second largest tropical rain forests, after Brazil. The current crisis in Indonesian forestry reflects the fundamental failure of forest policies and management practices, which are strongly influenced by colonial history. Prior to the colonial era, forest covered approximately 90 percent of the land area (World Bank, 1990). This section on the history of Indonesian forest management places the origin of state ownership in Dutch colonial rule. It then shows that this policy did not change during the independence era. In the modern era, forestry was expected to contribute to general socio-economic development. Finally since 1998 new forestry policy has given attention to community forestry in an attempt to localise the benefits of forestry.

The principle of state ownership of forestlands was established in 1870 under Dutch colonial rule. The first deliberate colonial forestry activities in Indonesia were directed at gaining control over timber resources, which were needed for the effective exercise of colonial power and/or which were commercially valuable. For instance teakwood in Java was exploited for ship construction (Peluso, 1992). Because of the important strategic and commercial values of teakwood, the colonial government took control of large tracks of forestlands. On those lands, the valuable timber species were managed without considering tree species needed by local people (Wiersum, 1999).

In addition to securing access to timber supplies, colonial forestry policies focused on environmental matters. By the end of the 19th century the protection functions of forests were already recognised. The negative climatic effect of deforestation was already a matter of concern in the 1880s. Whereas the first Forest Ordinance of 1865 dealt mostly with measures to maintain teak forest for timber production, in the second Ordinance of 1874 the need to establish 'jungle' reserves for protective purposes in hilly areas was also mentioned as a forestry task (De Haan, 1930 in Wiersum 1999). These environmental aspects were especially of concern in relation to the function of the colonial cultures. Forest conservation was considered essential for the maintenance of the climatic conditions needed for colonial cash-crop production, such as cocoa and tea, or the maintenance of water supply for lowland agriculture including colonial sugarcane (Wiersum, 1994). Consequently, according to European ideas, a forest cover of 30 percent was considered the minimum for maintaining environmental conditions (Hobley et al., 1996). Thus the protection of forests was not only based upon commercial timber interests, but also on strong conservation principles.

The result of colonial forestry policies was a gradual expropriation of control over forestlands and tree species. The control over forestlands represented the foundation of the legitimacy of the forestry services. The need for professional management to protect these lands and to regulate their exploitation justified their claim on the land. The exploitation of trees in the production forests both provided revenues to the government and covered the costs of the forest service. These benefits further strengthened the legitimacy of the forest service. Thus, the forestry services became empowered to determine the use of the reserved forest lands, and the manner in which these lands were to be managed, including the type of timber species to be cultivated (Peluso, 1992). To secure profitable exploitation of trees on the forestlands, in many cases the forest service also gained control over the forest labour (*ibid.*).

To ensure sustained yield of timber resources and maintenance of protection reserves, the major task of the forest service was to combat the social obstacles to these objectives. Local forest utilisation practices were considered to be damaging to the objectives, so they had to be controlled. This often resulted in positivist criminology in respect to local people (Guha, 1999) with local people sometimes being put in the same category as natural risks, wild animals and pests or diseases. To exercise control, the activities of the colonial forest services became characterised by territorial duties and policing actions restricting forest use by local people (Dargavel et al., 1985; Peluso, 1992). The access of local people to forest reserves was restricted by various regulations on collection of fuelwood or other non-timber forest products, while other activities such as cutting timber were totally prohibited. Control over timber trees was even extended from the forestlands to all lands with local people having to obtain permission from the forest service to cut timber species on their private lands (Dargavel et al., 1985).

The possibility of introducing community forestry was discussed in the 1920s. It was suggested that forest management could be divided between the Forest Department, being in charge of crucial watershed protection and commercial timber, and local communities being in charge of the remaining forests. These ideas were not implemented, however (Persoon and Wiersum, 1991).

The basic approach to forestry did not significantly change when Indonesia obtained independence in 1945. Indonesian foresters who had lived for a considerable period as independence fighters in rural areas recognised that attention should be given to the people's needs for housing materials, fuelwood and grazing (Peluso, 1992). Such recognition fitted well within the socialist policies in many of the newly independent states. However, other concerns were dominant in shaping Indonesian forestry policies. A major factor contributing to a further strengthening of forestry policies, which emphasised state control over forest resources, was the prevalent principle of the modernisation theory of economic development (Rostow, 1961). According to this theory,

economic development (characterised by economic growth at the national level) should be attained through structural transformations of the economy involving a transfer of resources from the traditional agrarian sector to modern industrialisation. This approach was strongly endorsed and promoted by the various United Nations agencies, which had the task of assisting the development of newly emerging states (ibid).

In forestry, the modernisation theory resulted in the belief that the forest sector should contribute optimally to economic development of the newly independent countries (Dargavel et al., 1985; Westoby, 1989). Because forests formed an important resource for national economic development according to Basic Forestry Act 1967, they should be maintained as a national asset. It began in 1966 when the Indonesian government allowed investments in forest industries and expected them to trigger a self-sustained growth of wood-processing industries, which would allow benefits eventually to trickle down to all strata of the population (Dargavel et al., 1985). The processing of wood from natural forests was expected to provide valuable export materials and assist in improving the negative import–export balance of the country. Thus through the provision of raw materials for export, forestry would contribute optimally to socio-economic development. As a result of this modernisation theory (Wiersum, 1999), the macro-economic orientation of colonial forestry as well as the policy of state control over the forest resources became even stronger than in the colonial times. Under the Soeharto regime (1965-1997), 65 million hectares of forestland were leased to logging companies representing one third of the national land area (Poffenberger, 2000). The Indonesian Ministry of Forestry (MoF) with limited staff presence in the field, holds the authority to grant vast concessions to timber companies often influenced by powerful political and private sector interests

Unfortunately, in the attempts to use forests as a means of national economic development, the development of forest management in Indonesia lagged behind the development of forest exploitation (MoF, 1994). It became recognised that the prevalent approach did not contribute much towards rural development (World Bank, 1995). The supposed contribution of forestry to economic development through the creation of employment and income from timber plantation and wood industries did not materialise. Too often, local people hardly profited from forestry policies because the benefits were accumulated and transferred to the urban elite and foreign investors. The fall of former President of Indonesia, Soeharto and his regime in 1998 was believed to be one impact of the huge socio-economic discrepancies created by the policies in the modernisation period. Therefore, a change of thinking was needed if the government of Indonesia wanted to achieve widespread economic benefits from the forestry sector.

Following Soeharto's resignation, populist political leaders demanded greater recognition of the rights of local communities and elimination of political influence of private sector interests. Poffenberger (2000) noted that Indonesian NGOs, academics, and development agencies played important roles in informing and guiding the new forest policy debate. This event marked the realisation of a new paradigm in Indonesian forest management, a shift from forests as a means to contribute to national economic development to forest utilisation for the welfare of Indonesian people. It became recognised that restricting local people's access to forest resources caused more negative impacts on the protection of the resource itself (FAO, 1985). In this view, the involvement of local people in Indonesian forest management should be stimulated. The reformed policies (MoF, 1999) emphasised conservation and management of existing forests, understanding the role of common property and the need to conserve the cultural integrity of tribal forest dwellers. Policies included the development of collaborative forest management that involved local people as well as its integration in local-level planning. In this paradigm, it is believed that forest benefits for local people can best be assured when they can manage the forests themselves. Learning from the experience of other countries, Muslimin Nasution the Minister of Forestry in 1999 said that the Indonesian forest management would be properly implemented when local communities have approximately 80 percent share of the management (Anwar and Muhtadi, 1999). The MoF's 2000 Work Plan highlights the adoption of necessary legislative and regulatory instruments to encourage community participation in Indonesian forestry management and protection.

1.4 Community Forestry

In contrast to traditional forestry, which concentrates on the production of industrial wood, community based forest management (CBFM) is primarily directed to community sustenance and wellbeing. In community forestry, foresters facilitate the community's manipulation of the ecological systems to increase the production of socially desired benefits (output of goods and services on a sustainable basis) and to mitigate negative outcomes (floods, soil erosion, drought, and fires). CBFM cannot be separated from rural development, since it deals not only with trees but also with socio-economic problems. It is one reason why community forestry is considered as a new approach. It also cannot be separated from the environment in which it must function. CBFM represents a promising alternative approach to the administration of state forestlands. It assumes that rural people if given responsibility for the forestlands in their area, can develop management skills to administer those resources effectively (Poffenberger and McGean, 1994).

When this new approach was suggested, various terms were used to represent it, notably community forestry and social forestry. Some authors considered these terms synonyms (Gregersen et al., 1989; Wiersum, 1990; Peluso et al., 1994) but others interpreted them in specific ways (Arnold, 1991; Blair, 1986). However, they both refer to "any forest management activities or situations, which closely involve local people in forestry and tree-growing activities, for which rural people assume (part of the) management responsibility, and from which they derive a direct benefit through their own efforts" (Pardo, 1985). Other authors give the terms in a more specific meaning (Arnold, 1991; Hobley et al., 1996). For instance the terms are described as follows (Hobley et al., 1996):

Social forestry: An umbrella term for various schemes aiming at forestry for local needs, especially individual farm forestry, for communal village planting and for forest management by villagers.

Community forestry: A broad term, which includes indigenous forest management systems and government-initiated programmes in which specific community forest users protect and manage state forests in some form of partnership with the government.

In Indonesia the terms are distinguished in accordance with where the CBFM projects are implemented although the objectives are virtually the same. The term **social forestry** is used if the projects are taking place in the state forestlands such as in Java with specific objectives to meet the basic needs of people involved and commercial purposes especially from non-timber forest products. **Community forestry** projects usually use non-state forestlands such as private lands and community lands with specific objectives in meeting the basic needs and commercial uses for timber and pulp (MoF, 1995; MoF, 1999; Potter and Lee, 1998).

Gilmour and Fisher (1997) note, "The early approaches to community-based forestry in the 1970s were referred to as "social forestry" and were often limited to hiring local villagers to establish wood lots. The questions regarding community rights were beyond the mandate of the state. The Indian reports stressed the social forestry role in improving forest management, while community forestry was focused on its rural development context (FAO, 1978; Poffenberger and McGean, 1998).

The Food and Agricultural Organisation of the United Nations (FAO) defined community forestry in 1978 as: "*Any situation which intimately involves local people in a forestry activity*". The original concept of community forestry was based upon three main elements. These were fulfilment of the basic needs of fuelwood, fodder, and timber at the rural household and community level, supplying food and the environmental stability for cropland, and the generation of income and employment in rural communities (FAO, 1978).

Gilmour and Fisher (1997) have extended the above definition to emphasise issues of authority that exist within community-based forest management. They defined it as "the control and management of forest resources by the rural people who use them especially for domestic purposes and as an integral part of their farming system". As Poffenberger (2000) said "The question of control is arguably the most important issue surrounding the debate regarding the role of communities in forest management".

The growing importance of community forestry in many countries, particularly in supporting forest management and rural economic development, attracted some authors, forestry agencies and international agencies to define and formulate the term of community forestry. Some of them related community forestry to one of the forest functions, i.e., the social function was often referred to as social forestry, while others argued that community forestry should be distinguished from the term of social forestry. However, whatever the terms used to describe community forestry, it has been gaining an important role in developing forest management in many countries.

As has been discussed in the previous section, realising the potential role of local community involvement in assisting the government to overcome deforestation problems, the MoF has introduced a new policy that promotes local community approach in current Indonesian forest management. Consequently, to ensure smooth operation of the policy as well as to guide the policy implementation to achieve the expected results, relevant researches in community forestry will be considered in detail here.

Many authors expressed the importance of community forestry in tropical forest management in different ways. Below are a few examples:

Foley and Barnard (1984) said that community forestry's role in forest management in developing countries has been described as follows:

Over the past decade, farm and community forestry has emerged as one of the principal responses to the problems caused by the widespread loss of trees and forest cover in the developing world. Its aim is to help people solve their own wood supply problems, meet their own needs, and preserve the environment in which they live by planting trees on their farms and around their villages.

Peluso et al. (1994) argued that community forestry has become an important element in core forest management in developing countries. As they pointed out:

It creates an opportunity to break down the barriers of mistrust and antagonism which often exist between forest services and the public, enabling the resources and expertise of foresters to be utilised and made relevant to the community in a way that has seldom happened before.

Usher (1990) noted that there is a growing realisation that tropical foresters have failed to fulfil the mandate vested in them to manage the forest to ensure 'sustainable' timber yields because of their inability to regulate greedy loggers. Nowadays they embrace local people in order to protect the remaining forest resources.

Community forestry also has been popularised in China, Korea, India, Malawi, Kenya, Tanzania, the Sahel, and the Philippines. FAO (1988) and the World Bank (1992) reported that in these countries, massive nationwide tree-growing programmes have been launched to replenish the stock of trees after the depletion caused by the previous decades of war, neglect, and over-exploitation. Although some doubt has been cast on the achievements claimed, there is no question that in many areas they were very substantial. With effective and appropriate support from governments, very substantial community forestry achievements can be made.

As also indicated in some developing countries, community forestry has become an important element in forest management. Experience shows that forestry without community involvement is unlikely to lead to sustainable development. By allowing the local people to control their own resources, the government expects to gain support from local people to manage forest areas outside the state forestlands in a sustainable way. This system will increase the community's resource potential, thus reducing pressure on state forests. The policy mechanism has as its aim the establishment of forests that are ecologically beneficial, sustainable, profitable, and that can be integrated with nature conservation. These are fundamental for regional and rural development processes. The policy is also considered as a breakthrough to improve the existing relationship between the forestry officials and the rural people. By introducing this approach it is expected that people and forestry officials can work together to safeguard forest resources (Peluso et al., 1994; Potter, 1996; FAO, 1988; Poffenberger, 2000).

Diverse approaches are applied in different countries for the involvement of local people in forest management (Poffenberger, 1996). For example, India is practising co-management of degraded forests with a partnership between local communities and the Forest Department. Many African countries are involving local people to strengthen park management and bio-diversity conservation. Countries like Canada, Panama, and the Philippines are developing policies and approaches to manage forest resources through an agreement with indigenous people. In Laos, the government allows 80 percent or more of all forestlands to remain under indigenous systems of management to ensure their resource sustainability.

1.5 Community Forestry in Indonesia

In Indonesia, rural development in forestry has formally gained acceptance since the International Forestry Conference in Jakarta in 1978. However, at that time Indonesia was still preoccupied with commercial timber harvesting and senior government planners had very little place in their strategies for local participation in forest management (Peluso, 1993; Poffenberger, 2000). Local people involvement has been long recognised in Indonesian forest management history, although the role is limited to labourer. The State Forestry Enterprise (Perhutani) has used local people in Java as wage labourers to plant teak since the 1970s (Peluso et al., 1994).

In 1993, University-NGO collaboration and several development agencies established the Community Forestry Consortium to promote community based forest management (CBFM) in Indonesia following a number of community-based forestry pilot projects initiated in Java, Sulawesi, Kalimantan, and Irian Jaya. With increasing support from international agencies including the World Bank, GTZ, and USAID, growing pressure has been placed on the government to address demands for greater recognition of the forest rights of local people. Indonesia also benefited from the presence of the International Centre for Agroforestry (ICRAF), the Centre for International Forest Research (CIFOR), and USAID's Natural Resource Management Program, all of which support active community forestry research, policy analysis, and capacity-building initiatives in Indonesia.

Since the fall of the Soeharto government in 1998, the Indonesian Ministry of Forestry (MoF) has been committed to shift to and implement the new orientation of Indonesian forest management from the old paradigm of timber-based management or economic-based management to community and resources-based management. This new paradigm seeks to ensure that Indonesian forest resources can be managed to contribute to social, economic and ecology functions with people as the ultimate beneficiaries (MoF, 2000). The new paradigm includes the changed system from centralised to decentralised forest management.

To actuate the new paradigm, the Indonesian government is continuing to launch CBFM programmes and projects with more emphasis on local community as the subjects rather than the objects. This approach encourages people's participation in managing forests for the benefit of rural communities. As part of rural development, the inclusion of CBFM has become an important element in Indonesian forestry. CBFM is expected to bring significant benefits by providing an opportunity to stimulate local economic activity as well as to improve forest resources throughout the country (MOF, 2000; Potter, 1996). Accordingly, the MoF has established more policies,

allocated more funding, and launched a programme to boost community forestry development that has been initiated in 1995.

The commitment to this policy direction has been outlined in Decision of the People's Consultative Assembly No.X/MPR/1998 concerning the Principles of Reform towards the Rescue and Normalisation of the National Life.

In the forestry sector, the responses to calls for a reform have been focused on the following three major steps:

- Promotion of efforts to empower the communities. The efforts involve adoption of policies that can accelerate the growth of a community-based economy that is self-supporting, solid, and sustainable.
- Eradication of corruption, collusion and nepotism in the forestry sector.
- Restructuring forestland use planning towards utilisation of natural resources in a sustainable, efficient, and equitable manner for the greatest benefits and welfare of the communities, thus creating a harmonious condition in the social, economic, and ecological aspects.

Various efforts and breakthrough measures have been undertaken to implement the call for a reform in forestry as well as in estate crops sector, starting with the establishment of the Committee for Forestry and Estate Crops Reform based on the Decree of the Minister of Forestry and Estate Crops No.521/Kpts-II/1998 dated 29 June 1998. Most of the members of the committee are from Universities, NGOs, associations, communities, and a few are from bureaucracy. The next step is to improve and revise laws and regulations, and to establish institutions, which are supportive of the implementation of the reforms that allow acceleration of community empowerment.

In 1999, the Minister of Forestry and Estate Crops issued Decree No. 865/Kpts-II/1999 concerning the involvement of local community in Indonesian forest management. This decree emphasises more that the management of Indonesian forest resources should always be oriented to promote local people's empowerment by giving them more opportunities to share the responsibilities. However, experiences of community forest establishment in other countries show that a good policy is less effective when in the real implementation the participation in forestry is directed from above (Hoskins, 1983; Repetto, 1988; Chambers et al., 1989; Hafner, 1990; Arnold, 1991; Carter, 1992; Rao, 1992). As Potter and Lee (1998) have foreseen, the Indonesian government might face difficulties in putting the policy into practice. They argued that the new democratic Indonesia would inspire local communities to oppose government projects if they do not adequately address the people's needs.

In carrying out a community forestry project there are two parties commonly involved, government and community that have different priorities. The government is concerned with how local people would participate in the project, while community is concerned with whether the project will deliver benefits to them (Messerschmidt, 1992; Rao, 1992).

Community forestry relies on people participation. For long-term success in the community forestry programme, people's participation is required. To get people to participate, identifying their needs from forests is necessary. Meeting people's needs must be the major focus of any community development strategy (Rao, 1992, Shah, 1992; Peluso et al., 1994). Research aimed at understanding people's needs and views is necessary to improve the government's approach in developing community forestry in Indonesia. Accordingly, this study was carried out to support the government's efforts in promoting community forestry in Indonesia.

1.6 Research Objectives

Although the government has formulated more policies to promote local people's participation in Indonesian forest management, misunderstanding or misinterpretation may lead to the wrong outcomes of the policies. Learning from the Reforestation and Regreening Programme, as well as the Social Forestry Programme in Java, the government concluded that lack of people participation in a community project is due to lack of investment and knowledge of those concerned, or lack of awareness by local people about the government's intention to help them. As a result, the MOF in some provinces in Indonesia introduced pilot projects that provide incentives and training to attract local people to grow trees on their private land (Directorate General of Reforestation and Land Rehabilitation, MOF, 1995). Such strategies are now being questioned, because as this study will show, the pilot projects do not guarantee the participant's long-term involvement.

This study is focused on identifying the farmers' or landowners' needs in community forestry projects as required for long-term participation and involvement. By completing an empirical study, this research highlights factors that motivate or discourage farmers to participate in community forestry, and the important point is how these factors are included in peoples' land use decision-making. Understanding farmers' decision making in tree planting, it is argued, broadens our understanding of farmers' aspirations relating to tree-planting projects.

This present research endeavours to support the Indonesian government to enhance programmes designed to encourage local people's and landowners' involvement in community forestry. The main aim is to understand why people plant trees for timber and pulpwood production. Gaining understanding means that the aspirations and needs of local people in this activity can be identified.

A second aim is to identify those government policies that support local people's needs. Therefore, this research has the following two objectives:

- (1) To understand why people planted or did not plant community forest trees in the study area. A number of questions relate to the objective. Did they expect economic benefit from selling the trees because they believe that trees have a competitive rate of return among other land uses? Did they plant trees because people realised that there are potential market opportunities to sell their trees? Did they plant trees because the government was able to create a favourable climate that encouraged them to positively participate in the tree-planting programme? Or were they just simply being used as wage labourers to plant trees in the designated tree planting project areas? Is there anything that motivated landowners to plant trees other than economic benefits? By understanding the reasons and constraints, as well as the aspirations of farmers or landowners regarding tree planting, the research will identify farmers' or landowners' needs as well as their goals. This research objective is designed to help the project planners and decision makers by providing them with accurate information that will enable them to design a better policy in tree-planting projects. Better policies will contribute significantly to the implementation of the new era of Indonesian forest management leading to local people's empowerment and their increased involvement in forestry.
- (2). To determine the extent to which existing policies encourage participation in community forestry. Key questions here include the following. Is the current policy really supporting people to grow and to gain benefit from trees that they planted? Will modification of the existing policies be required to create a conducive climate to encourage landowners to plant trees on their own land? Landowners have a right to refuse to participate as the government tree-planting project uses their property. Therefore, besides presenting information and alternatives this research purports to determine which policies are appropriate to support the tree-planting project in Riau Province.

This study was implemented in 1996 in response to the Indonesian government's needs for research to promote the government's effort to ease forest degradation and wood supply deficit in Indonesia, in particular looking at the opportunities to involve local people in plantation forest management. The economic crisis in 1998 that severely hit Indonesia followed by the fall of Soeharto government makes this study more relevant since the reform movement demands local people's empowerment and involvement in all aspects of the new democratic Indonesian government.

1.7 Study Area

As informed by the literature review in the next chapter, most of Indonesian research on farmers' land use decision-making regarding tree planting was conducted in Java Island. Therefore, this research decided to use Riau Province of Sumatra for the study area and the objective of this section is to explore the suitability of this province as the case study area (see Figure 2.). In addition, this section provides background information on the province, including an overview of population characteristics, climate, economy and forest industry.

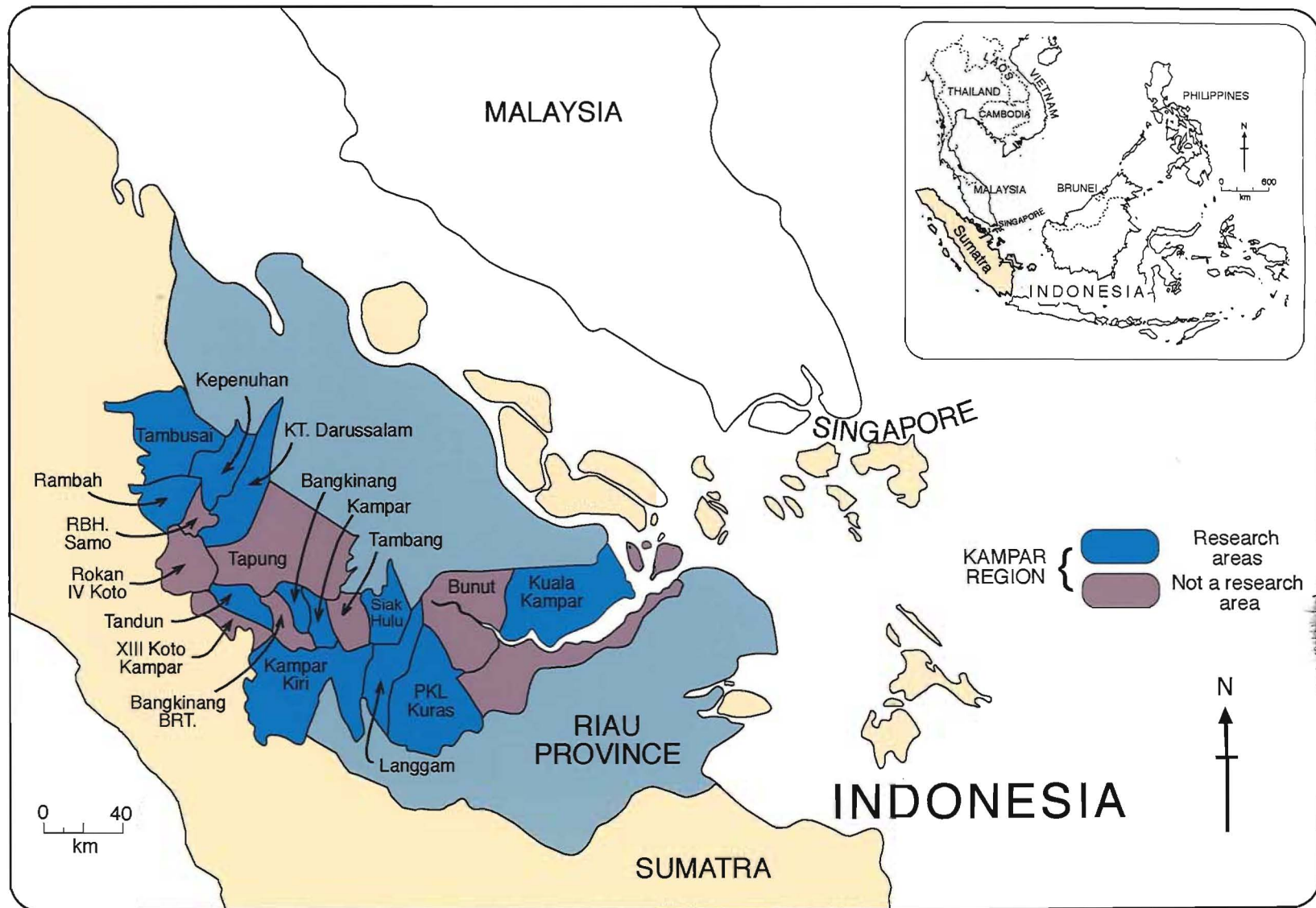
Riau Province is located in Sumatra (see Figure 2) and considered to have abundant natural forest resources. Riau Province has the fourth largest natural production forest areas after Kalimantan, Maluku and West Papua and has the third highest number of logging companies. However, Riau is undergoing huge forest depletion due to excessive logging practise, forest fires, shifting cultivation, and the massive expansion of oil palm estates that all contribute to wood demand which now exceeds the rate of supply. The government has launched several replanting programmes to overcome the problems such as HTI, community forests, and greening.

Riau Province, together with a few of the other outer island provinces in Indonesia, was selected, as a pilot project area for community forestry development. Accordingly, it received more funding from the central government (Jakarta) than the provinces, which were not selected as pilot projects. Compared with the other selected provinces Riau was considered to have the largest community forests area, most of which are found in the Kampar region. With those two features the research presumed that, compared to the other provinces, Riau was a good source of project reports, evaluations, assessments and other secondary data. In addition, because of its community forests, the Kampar region was chosen as the actual study area.

This section also presents information on present farming practices in Riau as this research found that among other factors, the present farming practices that emphasise subsistence fulfilment and rely on natural forests have not encouraged farmers to grow trees. This is in contrast with the Riau Forestry Regional Office assumption before commencing the project that Riau people could be easily encouraged to grow trees because they were used to growing and to maintaining rubber trees (Kanwil Kehutanan Riau, 1996).

Figure 2: Study area location, Kampar Region, Riau Province, Sumatra.

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1.7.1 Demographic Profile of Riau Province

Riau Province with a total area of 95,562 km² has a population of 3,667,700 people in 660,000 households. Population density averages 35 people/km², with about one million people in urban areas and more than two million people in rural areas. The majority of the population is Moslem. During 1980 - 1990, the population grew at 4.3 percent per annum and during 1990 - 1998 the growth rate was 2.94 percent. The average income is Rp.507,965 per year (US\$ 230 per year). People of working age (10 years and above) account for 64.3 percent of the total population or about 2.1 million. Employed people total one million of whom 58.6 percent work in the agricultural sector, 13.2 percent work in the industrial sector and 28.1 percent in the service sector. Job growth rate is expected to reach 6.1 percent per year, so it is expected that Riau can create new jobs for 480,000 people in 2001 (Riau Statistics, 1999)

Indigenous Indonesians make up almost 80 percent of Riau's population. Riau has a distinct culture that is separate from other provinces in Indonesia. Islam has greatly influenced the population's way of life including culture and tradition. The people historically rely heavily upon the natural resources for their livelihoods, mostly in agriculture, in which shifting cultivation is still commonly practised. Riau is considered strategic due to its closeness to Jakarta and Singapore. This advantage significantly contributes to business sector development in Riau which is dominated by ethnic Chinese. People from other provinces make up 12 percent of Riau's population, mostly Javanese people who work in the service sector. Transmigrants from Java who live in transmigration areas account for 1.4 percent of the population (Daswanto and Thalib, 1995; Dinas Kehutanan Riau, 1995; Riau Statistic, 1998).

Riau Province extends 9.8 million hectares in the east and centre of Sumatra Island. Until recently 6.5 million hectares were classified as forestland. Forty percent of the province was under protection forest. Riau Province has numerous off-shore islands which range from small uninhabited islands less than one metre above sea level to the large and economically important Batam Island. The environments of these islands still remain relatively poorly studied. Mainland Riau is dominated by extensive areas of wetland in the east of the province. Peat and tidal swamps make up more than 40 percent of the province and a further 20 percent is flat and poorly drained. This poorly drained coastal belt rises inland to become undulating to gently rolling plains, which make up the balance of the terrain.

Less than 10 percent of the province is hills or mountains, part of the Barisan chain of mountains forming the central spine of Sumatra, and located along the border with West Sumatra. Soils are highly weathered with very few nutrient rich soils. Almost 59 percent of the soils are poorly drained,

and 81.2 percent of Riau Province has slopes in the range 2-15 percent (Kanwil Kehutanan Riau, 1995). Most productive land will be found in this range although the 16-25 percent slope range encompassing 5.66 percent of the province will also have potential for tree plantation. The steeper slope account for more than 13 percent of the province and will be subject to the cost constraint for industrial plantations though there will be a need for smallholder tree plantations or community forestry in these areas.

1.7.2 Climate

Rainfall in Riau is abundant with the annual average ranging from 1,715 mm to 3,402 mm occurring in 94 to 202 raindays at average intensity of 20 mm/rainday. The average high intensity of rains is about 86 mm to 173 mm in hours. From long-term averages it was observed that ample rainfall occurs almost evenly distributed in the province with wetter condition in the middle area, with almost no dry period, though July is often dry in Pulau Kijang and Tanah Putih stations.

Temperature fluctuates very little around 26 to 27⁰ centigrade with almost no seasonal variations. Daily sunshine hours averaged between 3.5 to 4.9 out of the 12 hours possible sunshine hours. Relative humidity of more than 80 percent is common throughout the year. Estimated precipitation is between 1300 mm to 1400 mm per year.

1.7.3 Economic Structure and Growth

Oil and gas presently dominate the provincial economy but it has a wide range of other resources. Industrial development and the service sector are growing rapidly and it is intended to further develop the industrial and manufacturing sector. Oil and gas contribute almost 75 percent of the total Gross Domestic Regional Product (GRDP) (Riau Statistic, 1999).

The annual growth of the GDRP of Riau without oil and gas during 1994 – 1999 was 9.6 percent. Riau's non-oil GDRP in year 1997 in constant 1998 prices is estimated at about Rp.1, 900, 719 with oil and gas it was Rp.10, 805, 100. The total GDRP of all the 27 provinces of Indonesia together is Rp.94, 516 billion. This means that Riau's GDRP in year 1997 was 11.4 percent of the Indonesia total GDP (Riau Industrial Office, 1998)

The main constraint on the economic development of Riau, compared to other provinces in Sumatra especially those with high GDRP, is the inadequate infrastructure. Basic infrastructure such as roads, bridges, harbours, transportation and communication facilities are often classified as poor (Riau Industrial Office, 1998).

1.7.4 Riau Natural Forest Resource

According to Forest Land Use by Consensus (TGHK) formalised by the Decree of Minister of Forestry No.173/Kpts-II/1986 dated 6 June 1986, Riau tropical rain forests has a total area of 9,456,160 ha which comprises the following functions (Table 2):

Table 2: Riau Forest Areas and Their Functions

Forest functions	Area (Ha)	%
Protection forests	897,150	9
Nature, Game reserves, recreational forests	451,240	5
Production forests	3,857,685	41
Convertible forests for other purposes	4,250,085	45
T o t a l	9,456,160	100

According to aerial photos taken in 1993, Riau had virgin forest area as part of production forests with a total area of 1,585, 110 m² ha⁻¹ with the average volume at only 29.49 m³ per ha. Fifty-six logging companies in Riau were operating in 4,401,947 ha of forests in 2000. The number of active logging companies is much lower compared to those in the early 1990s when there were 187 logging companies operating in 8,640,000 hectares forested areas. Maximum log production of these logging companies was estimated to be about 3.9 million m³ annually, while the need for logs for wood industries in Riau is 4.36 million m³ annually if they are operating at their full installed capacity (see Table 3).

Riau Province is a sparsely populated primary producing province. The large range of physical environments has given rise to a diverse range of land use types but difficulties in communication have limited the commercial exploitation of this diversity. Exploitation of the natural forest has played a considerable role in the province economy and the lives of the local people and this will continue to be the case. Riau is also well known as one of largest producers of oil palm and rubber resin (Riau Statistics, 1998)

The forest-based industries in Riau consist of sawn timber processing, construction materials, and furniture and plywood production. In 1998 there were 98 wood based industrial units of large and medium-scale in Riau with an installed capacity of 6, 877, 591 m³ per year, creating job opportunities for more than 29, 893 workers and a total investment of more than Rp.74, 379 million. A breakdown of the industries is shown in Tables 3 and 4 in the next page.

Table 3: Full Installed Capacity and Actual Utilisation of Forest Based Industries in Riau

Type of Industry	Number of units	Raw material requirement (m ³ /year)	
		Max capacity	Actual usage
Sawlog Based Industries			
Plymill	11	1,879,632	1,400,700
Sawmill HPH	33	1,353,800	639,800
Sawmill non-HPH	114	1,481,604	183,126
Wood working	9	49,000	15,000
T o t a l I	167	4,764,036	2,239,036
Non Sawlog Industries			
Chipmill	3	541,885	448,000
Pulpmill	1	3,403,000	1,674,130
Charcoal	300	187,000	30,000
T o t a l II	304	4,131,885	2,239,036
T o t a l I + II	471	8, 895,921	4,911,556

Source: Annual Report of Riau Provincial Forestry Office 1997/1998 and Work Plan for 1998/1999.

Table 4. Forest-Based Large and Medium-Scale Industries in Riau in 1998

Type of Industry	Number of units	Installed capacity	Total Investment (Rp billion)	Total Labourers
Saw Mill	46	2,705,404	28,357	6,357
Plywood Mill	13	1,879,632	44,542	22,171
Wood Chip Mill	3	541,885	-	-
Wood working	10	179,034	137	180
Moulding	6	155,362	248	1,602
Dowel	3	54,974	1,065	63
Furniture	1	1,350,000	-	-
Pulp Mill	16	11,300	30	60
Total	98	6,877,591	74,379	29,893

Source: Regional Office of the Department of Industry, Riau, 1998

As has been mentioned before, Riau suffers from wood supply deficit. A consulting firm, PT Intanselaras Konsultindotama (1996), mounted a study to analyse Riau wood demand and supply projections. These projections were divided into two classes, high quality sawlogs harvested from natural resources, and medium quality sawlogs harvested from Industrial Forest Plantation (HTI) and community forests. The study projected a moderate decline in high quality wood supply from approximately 3.56 million m³ in 1995 to become 1.79 million m³ in 2030.

The main factors responsible for this decline are the removal of production forests and the increasing number of the convertible forests. On the other hand, medium/low quality wood supply appeared to be increasing for the projection period, from 0.12 million m³ in 1995 to become 2.08 million m³ in 2030. This increase is mainly predicted to come from industrial timber estates (HTI), and some smaller portion from the community forests. However, there was a problem with the database used by the company to build the projections. The database was constructed by the MoF in 1995 that merely relied on the plantation planning and progress in 1995. This report clearly ignored the failure of HTI and the low level of interest of landowners to plant trees in 1997.

Log production in Riau comes from natural production forest. Two activities serve as a source of timber from natural forest, RKT (Rencana Karya Tahunan - Annual Logging Area) and IPK (Ijin Pemanfaatan Kayu - Timber Utilisation Licence). RKT is the annual plan of logging activities used by HPH holders (Hak Pengusahaan Hutan - Concessionaires). The size is determined by dividing all the manageable concession area, e.g., limited production forest, production forest and conversion forest by corresponding concessionaires' rotation period (35 years). IPK is a licence given by the Ministry of Forestry to a third party (HPH or non HPH) to allow them to clear fell and to transport the timber out from convertible forests that have been designated for other uses (mainly for transmigration settlement, HTI or estate crops).

According to the MoF latest statistic, there are 56 HPHs (concession holders) still holding licences to manage the natural production forests in 2000. The average sawlog production by HPH through the RKT system during the period of 1998 - 2000 was 2.4 million m³ per year. In addition, two HPHs also produce pulplogs/chips through THPB (Land Clearing and artificially Regenerated) system which amounted to about 2 million m³ in 1999. The average sawlog and pulplog production during the 1998 - 2000 were 1 million m³ and 1.8 million m³ per year respectively.

In addition to natural forest, other potential sources of timber in Riau are HTI and private forests (hutan rakyat - community forests). The actual plantation of HTI pulp up to 1999/2000 was only 74,198 hectares or 31 percent of the target. The actual HTI non-pulp in 1999/2000 was 11,309 hectares or 28 percent of the target. In very limited quantity, rubber timber from estate crops has recently started being traded for furniture utilisation. Community forests accounted for 11,890 Ha in 1997 and mostly planted with *Paraserianthes falcataria* (sengon), *Feronema canescen* (sungkai), *Acasia mangium*, and *Eucalyptus spp.* It has been expected that both plantations will provide a significant Riau timber supply in the future (Wurjanto, 1997). Riau also imports logs from other provinces in Indonesia. Logs imported in (1997-1999) were about 318, 850 m³, 340, 000 m³, and 423, 000 m³ respectively.

The wood-processing sectors of Riau, especially the non-HPH sawn timber industries, operate under maximum installed capacity owing to the wood supply deficit. The actual utilisation in 1998/99 for non-HPH sawn timber industries was only 483,126 m³ or as low as 32 percent of their full installed capacity (1,484,604 m³ per year). The actual utilisation during the same period for HPH sawn timber mills was about 1.4 million m³ or about 47 percent of their full installed capacity. The reported utilisation capacity of plywood industries during the same period was higher at 1,400,700 m³ per year or about 75 percent of their full installed capacity of 1,879,632 m³ per year. The utilisation capacity of wood working during 1998/99 was only 15,000 m³ or about 31 percent of their full installed capacity at 49,000 m³ per year. The combined average utilisation of the sawlog-based industries was about 50 percent of its current full installed capacity (Kanwil Kehutanan Riau, 1999)

The actual usage of chip mills and pulp mills that use pulp logs as their raw materials was as high as 83 percent and 49 percent of their full installed capacity respectively, while the charcoal industries only reach 16 percent of their full installed capacity (ibid)

In addition to internal demand from Riau wood based industries, logs are also exported to other provinces. The export of logs to other provinces during 1990/91 to 1998/1999 showed an increasing trend from only about 145,000 m³ in 1990/91 to almost 1,700,000 m³ in 1998/1999. The latter represents 88 percent of the total sawlog production of Riau in 1998/99 (ibid).

The need of the wood industry for raw material in Riau will be more or less 10 million m³ per annum when it operates in full capacity (Kanwil Kehutanan Riau, 1997). If they only operate at 80 percent of their capacity they still need around 8 million m³ raw wood annually. Therefore, the existing HPHs areas are only able to supply no more than 2 million m³ per annum. So, there is an obvious wood deficit occurring in Riau. However, the wood industry in Riau does not complain about lack of wood. So, where is the supply coming from?

Since 1991 the MoF has given permission to convert some forestland to other land uses for development reasons such as transmigration, estate plantations, infrastructures, real estates etc. The forest status subsequently changes to other status except those that are used as timber estate plantations (HTI). Nevertheless, the status of the land remains as state land. The permitted forest areas to be converted to other purposes have to have a volume of less than 29 m³ per hectare (thin forests). However, it frequently happened that the MoF gave permission to convert forest areas that have more timber 30 m³ per hectare (thick forests) and granted the successful applicants with IPK (Ijin Pemanfaatan Kayu) or Timber Utilisation License. This licence allowed the holders to clear the projected areas by cutting the existing timber, transporting and selling it to any mills.

There was evidence that the forest conversion holders were only interested in removing the timber from the proposed areas for immediate profit, not for the work as stated in their forest conversion proposals. This malpractice could be done with the help of corrupt forestry officials, and this scam had been commonly recognised in Riau Province. The big forestry companies, estate companies, army co-operatives, foundations or any group that had links with powerful politicians, high ranking government officials in Jakarta and conglomerates were among those granted IPK.

Wood from the IPK is believed to be able to partially fulfil the disparity between wood supply and demand in Riau Province, which amounts to 6 million m³ per annum. Wurjanto (1997) disclosed that 80 percent of wood transactions in Riau actually came from stolen timber. The illegal cutting occurred in forest protection areas, within the concession areas, and the conversion forest areas. Lack of government control, bribery, collusion, and crises of ownership are among the causes of timber theft.

Interviews with local people who were involved with this illegal business revealed that they were paid to do so. Those behind this activity are usually rich and powerful groups. The authority seldom reaches the masterminds. When the illegal loggers get caught red handed and their chainsaws confiscated the masterminds simply pay the fine and the loggers come back to work. The theft sponsor pays the loggers US\$7 a day. They can cut more than three trees per day individually. The stolen tree normally has a volume of 2-4 m³ ha. The price for illegal wood is US\$ 15 per m³ delivered.

1.7.5 Plantation Forests and Reforestation Efforts in Riau

Realising the growing threat to Riau forest resources, great attention is being given to conservation and protection issues as these are seen as being integral to protecting new developments in infrastructure and also wood supply (Riau Statistics, 1995). Further large developments are planned with the appointing of a second large pulp mill shortly (Kanwil Kehutanan Riau, 1997). The forestry regional office suggested that forest plantation will play a role in maintaining the already established forest industries and in protecting the fledgling conservation-related tourist industry. As speculated by the Asian Development Bank (1996), successful forest plantations in Riau will be at least 20 times more productive than its natural forests and therefore will use less land than natural forest to meet the demand. This idea is to take some of the pressure off exploitation of natural forest, which is however still an uphill task to realise (Kanwil Kehutanan Riau, 1999). Another objective of the forest plantation is to maintain a balance between the conflicting demands on forestland from other land clearing developments, for instance estates and agriculture, for the sake of economic growth.

Forest plantations in Riau encompass all tree-planting activities (Asian Development Bank, 1996):

- 1) Industrial forest plantations/Industrial timber estates (HTI)
- 2) Agroforestry and community forestry activities
- 3) Reforestation for both rehabilitation and protection

Hypothetically, a well-managed forest plantation will improve the acceptability of Indonesian forest products in an increasingly environmentally aware world market (International Tropical Timber Organization, 2000). Nevertheless, current implementation of all types of forest plantations is below expectation and often very poor. The Riau Forestry Regional Office (1997) reported that less than 200,000 hectares areas of HTI were achieved from the target of one million hectares. The community forests accounted for no more than 12,000 hectares.

Besides HTI, *hutan rakyat* or community forest is considered to be capable of providing a significant contribution to forest plantation development efforts in this province. Daswanto and Thalib (1995) claimed that Riau people have long recognised community forestry. However, it can be argued that community forestry, with the main activities of planting trees, probably had not been introduced until the introduction of greening projects in 1990s.

Community forestry or *hutan rakyat* in Riau is a series of forest management activities that are carried out on privately-owned land by individuals or communities on smallholder commercial forest. The management is designed for commercial timber production including pulp and sawn timber. Riau community forests are classified into three different types: (a) subsidised and supervised by the government project, (b) financially assisted and supervised by timber companies or in the form of partnership (c) self-motivated or self-reliant tree planters.

The government project aims to convince the local people that better tending will lead to increased production. The landowners are provided with free seedlings and technologies in planting and tending are introduced. Extension workers and Non Government Organisations (NGOs) have been employed to target the existing farmer groups to disseminate the advantages of tree planting. The partnership system aims at establishing private wood resources to support the supply for the pulp industry of the company partner. The MOF introduced a scheme by encouraging HPH in Riau to foster community forest owners. The HPHs act as the guarantors for loans provided by the government. The loan aims to assist community forest owners (debtors) in financing the plantation establishment and tending. When the plantations reach maturity, the debtors have an obligation to sell the timber to the guarantors. Self-motivated community forestry areas also could be found outside the above two types of CBFM. This type of management is financially independent.

The Riau Regional Forestry Office (Kanwil Kehutanan Riau) (1977) estimated that more than 11,000 ha of community forests can be found throughout Riau Province. In 1999 there was evidence that farmers who were previously committed to involvement with community forest projects had converted their trees to oil palms. This trend has given a slightly negative image to community forest development projects. There were large areas previously designated for community forest that had been converted to oil palm. This circumstance forced the Kanwil Kehutanan Riau in 1999 to update its plan that consequently caused a big loss from the seedlings investment and preparation.

1.7.6. History and Problems

Hamidi and Ahmad (1993); Daswanto and Thalib (1995) acknowledge that some community forests in Riau have emerged as a result of the regreening programme that started in 1979. However, they argue that Riau has recognised community forestry since Dutch colonisation. There has been a harmonious relationship between the Riau people and the forest, long before the government launched the community forestry programme. The local people used to plant local tree species on their own lands for such reasons as: subsistence, erosion prevention and reservoir, status (ownership designation) and investment.

Historically, the Riau people have operated sustainable forest management practise. People divide the *adat* forests (customary forests) into three purposes based on their customary laws, *rimba peladang* (forest for food crop cultivation), *rimba simpanan* (limited production forests) and *rimba kepungan sialang* (protection forests). Through *rimba peladang*, forest can be cut and used for shifting cultivation. All villagers are allowed to use this area and the procedures are arranged by the customary chiefs to ensure resource sustainability and user equality. Villagers who need timber for subsistence purpose are allowed to cut trees in the *rimba simpanan* areas as long as they do it in a manner that does not jeopardise the resource. The community strictly controls this activity and penalties are imposed on offenders. No single tree is allowed to be cut in the *rimba kepungan sialang*. This forest is reserved as ecosystem protection. Access to this forest is restricted. The villagers are allowed only to utilise the non-timber products such as fruits and leaves (Daswanto and Thalib, 1995).

The first immigrants from Java arrived in Riau in 1882. As part of their island farming tradition, they brought with them *Paracriathes falcataria* (sengon) seedlings to be planted around their houses or home gardens. The reasons for planting the trees were as their experience in Java recognised, this species is good for meeting domestic purposes such as improving soil fertility and protection, shading, fuelwood, construction woods, and boundary marking (Pulungan and Sinaga

personal communication, 1997). Thus, sengon trees were to be found growing well in transmigration resettlements.

In 1989 to 1992, the MoF launched its regreening and reforestation programme to rehabilitate the degraded forestlands as well as to increase the number of trees in some private lands. The programme included the establishment of 28 village nursery (KBD) units, and covered 6,370 ha of plantation areas. Under this regreening campaign the 28 nurseries successfully produced 2,400,000 seedlings. However, it was considered that the regreening programme was not well accepted by the majority of the local community because they did not address the major problem that the local community faces.

In line with the implementation of the national community forestry programme, in 1994 together with some selected provinces in Kalimantan, Sulawesi, Irian Jaya, and Java, the Riau Regional Forestry Office launched a community forestry programme. The government also considers using unproductive lands, bare lands, and logged areas in Riau as community forest areas. Satellite imagery interpretation showed scattered unproductive lands amount to 754,036 hectares, of which 548,000 hectares are state forestlands, and 206,036 hectares are privately owned and communal lands (Directorate General of Land Rehabilitation and Reforestation, 1994).

Simon (1995) calculated that if the 206,036 hectares can be planted with *Paraserianthes falcataria* that has a seven-year rotation with its average production 150 m³ per ha, the lands will produce 30,000,000 m³ timber product or 4,000,000 m³ annually. This amount added to the logs harvested from the forest plantation area (HTI) will be enough to meet demand in Riau. Therefore, the use of wood that is extracted from plantation forests will reduce the pressure on Riau's natural forests. However, this assumption will work only if the local people are willing to plant trees on these lands.

Attempting to support the community forestry programme by assuming that every farmer in Riau has an interest in tree planting for timber production, Simon (1995) suggested that if 58.6 percent of the population are farmers, there are 386,760 farmer households that can be regarded as potential participants in the community forestry programme. Those farmers, as he suggests, can be encouraged to establish community forests on unproductive lands either in or outside state forestland which accounted for 1,982,700 hectares (206 hectares are privately owned arable lands, and the rest are logged areas, shrubs and thicket in the state lands). Each farming household will have 5.1 hectares on which to plant trees, with a potentially significant increase of the farmers' incomes.

The project managers argued however, that encouraging people to plant trees on their land was an uphill task. It is absolutely up to local people to decide what is the best for their land. It is impossible to get people to plant trees by relying on a small institution with no supportive policies

(political will) provided by Jakarta. The status quo has been bringing frustration and desperation to people who wish to promote tree planting. They believed that even without demonstration plots local people would voluntarily plant trees if the MoF creates a market system for the wood products extracted from community forest areas. They suggested also that the low achievement of the tree planting projects was due to the lack of awareness among project participants of looking after their trees (Kanwil Kehutanan Riau, 1997).

Riau Regional Forestry Office and DHV consultants firm (1997) evaluated problems of low interest in planting trees and concluded that the local people were concerned with subsistence survival, they lacked capital and they did not have land security. Consequently tree planting did not enter their perspective because they could not be sure of harvesting the trees (no land security), nor did they have money, time, or land to invest in tree planting. Some groups who had spare capital, time and land and who had successfully planted trees complained of poor seedlings and support.

It has been frequently reported to Jakarta that lack of funds might deter landowners from planting trees. As quoted from the Asian Development Bank reports (1996), the present programme is not accessible to the majority of the local community because it does not address the major problems. Local people are concerned with subsistence survival. They lack a long-term investment horizon because they lack capital and do not have land security.

The government has planned to actuate the soft loan system since 1995, but it has not done so yet because the channelling banks in Riau required a complicated procedure for the borrowers. The loan is designed to help tree farmers establish and manage their tree plantation. It will be channelled through a regional bank to a company who fosters at least 900 hectares of community forestry areas owned by approximately 500 farmers. Each farmer will be granted maximum US\$ 900 per hectare. The money will be deposited to the company's account, and it will be directed to the members based on the progress made by farmers on the land. Although the fund is channelled to the company account, the responsibility to pay the money back, however, is still in the hands of the farmers. However, owing to administrative reasons, until the end of 1999 no single tree farmer in Riau had received the loan. On the other hand, some forestry companies have enjoyed the loan. It offers 6 percent interest per annum while the commercial interest is 18 - 20 percent per annum (Community Forest Soft Loan Scheme, Manual, 1997). This windfall would serve the company with a lot of chances to keep and to use the money for any purpose until a certain period (Wurjanto, 1999).

This system is obviously benefiting the companies. However, proponents of the policy argued that the loan scheme would also boost the partner system. It will encourage, as well as address the needs of, those who are committed to managing a forestry business on their private lands. The partner system will help the members with introducing suitable forest management techniques, and providing a secure market so that at the end of the day the communities would take advantages from the timber sale. However, who decides the timber price? Does the community have power to set the timber price? Does the government have power to regulate the floor price? Experiences testify that Indonesian Forestry Private Company Association (APHI) was powerful in regulating wood prices, taxes, fees, royalties, etc.

1.7.7 Present Farming Practices in Riau Province

Growing trees for timber is considered a new adoption for Riau farmers since their needs for timber or fuelwood can easily be obtained from the surrounding natural forests. Together with collecting woods in the forests, the traditional farming activity in Riau is rubber tapping. Many are also still practising slashing and burning natural forests to grow food crops. Since 1995 there has been an increasing number of farmers or landowners in Riau who grow oil palm.

The above activities revealed the dependency of local people upon the surrounding forests. These people used to have outright access to the forests because customary laws allowed them to use the forests for their daily life. They never thought about regeneration because they had numberless resources. However, since the government has granted the concessions and timber estate rights to logging companies, community access to forests was getting difficult. Gradually they have become isolated and have drifted away from their traditional forest because the forestry companies have limited their space. This situation has created local antipathy toward logging companies.

Before 1993, the communities developed rice farms through shifting cultivation with an area of 100 hectares for each farmer group. Since 1993 the communities have stopped opening new land because the locations have been too far away from their villages, the soil is very hard (stony), and a big flood occurred in 1994. Above all it is difficult to have good land and land clearing is time consuming. However, many are still practising this method, although the number is declining (Mansoer and Idwar, 1995; Kanwil Kehutanan Riau, 1996).

It has been a family tradition to clear forestland to plant paddy. Those who were still engaged with this practice explained that the harvest from growing paddy and other food crops was enough only to feed the family for four months. Limited access to lands, further location from home, shortening fallow period, cultural change in terms of co-operation within the community, difficulties in obtaining good variety, wild boar and elephant disturbances, all of them are factors discouraging people from this practice (Asian Development Bank, 1996).

Oil palm is an export commodity that is given first priority in the plantation estate development because of its healthy demand. A giant private company 'Plantagenag' first introduced oil palm in Riau in 1975 with a total area of 1,000 hectares. According to the survey result conducted by 'Marihot' Station in 1979, Riau's climate, topography, and its soil type are suitable for palm oil cultivation. Other contributing factors that make oil palm marketable are adequate roads built by oil companies and concessionaires, there is 'Dumai' Port which has a high capacity, and Riau is close to North Sumatra where the centre of estate state enterprise is located. The estate state enterprise applies PIR (Perusahaan Inti Rakyat) system or people centred enterprise to develop oil palm plantation. The area used for the plantation is usually divided into two categories, nucleus area and plasma area. The government uses the nucleus area as demonstration plots, and the farmers work within the plasma area.

A loan scheme is applied to finance this system and popular donor agencies such as the World Bank (IBRD) and the Asian Development Bank (ADB) are often behind this scheme. The estate state enterprise also guarantees the market. The participants (farmers) could be local people or Javanese transmigrants. Land for each participant is in the form of a three hectares land package that consists of 2 ha of main plantation (oil palm), 0.75 ha of food crop, 0.25 ha of house and home garden. The Regional Forestry Office (1997) recorded that a boom in demand for lands to be planted with oil palm started in 1995. People from North Sumatra initiated the demand for such lands. They are landowners who are familiar with the oil palm business in North Sumatra province. The declining productivity of the old oil palms has forced them to expand their plantations. Regeneration cost is considered to be a lot dearer than buying new lands, therefore they prefer to expand their plantation rather than renew their plantation, and they considered that acquiring lands in Riau is less expensive than land in North Sumatra. Their activity in Riau is allegedly enticing local people to sell lands with no legal title. Many of the lands are claimed to be state forest areas. Their activity also lured local people to plant oil palm on their private lands.

1.7.8 The Kampar Region

As has been mentioned in the previous section, the actual study location is the Kampar Region (see Figure 2). Kampar region is one of eight regions that constitute the Province of Riau. Forestry in Kampar is similar to that of Riau. The forests distribution in Riau is as shown below.

Table 5: Forest Distribution in Riau Province

Region	Thick forest	Swampy forest	Shrub, Remnant	Total forest land	Total Region	%
Kampar	1,365,292	907,610	315,812	2,588,714	3,056,379	32
Indragiri Hulu	618,588	214,209	169,870	1,102,667	1,253,872	13
Indragiri Hilir	73,849	737,347	23,673	833,869	1,232,582	13
Bengkalis	603,095	1,912,827	146,265	2,662,187	3,016,970	32
Kepulauan Riau	209,959	16,675	99,714	326,348	748,716	8
Pekanbaru	19,947	288	27,194	47,429	72,947	1
Batam	13,082	11,577	23,399	48,058	51,253	0.5
Dumai	6,477	180	0	6,657	13,613	0.14
Total	2,910,289	3,800,713	804,927	7,515,929	9,456,160	100

Source: The Land National Agency, 1996.

The table above shows that the Kampar region possesses the largest thick-forested areas as well as the largest shrubland remnant forests (315,812 hectares) in Riau Province. The community forests were targeted to rehabilitate the remnant forests. It was recorded (Kanwil Kehutanan Riau, 1997) that Riau has approximately 200,000 hectares of unproductive lands, of which 158,590 hectares are located in the Kampar region. Field observation shows that some of them are not degraded lands. They are still fertile with shrub and bush growing well on them. The Kampar Region has a total land area of 30,563.79 km² and of 2.17 km² water area (Kampar Statistic, 1999). Its topography is dominated by low land (75%), and the rest is hilly area that lengthens through the boundary of West Sumatra and North Sumatra. This region comprises 19 districts that consist of 231 villages.

The total population in Kampar region recorded in 1998 was 644,303 that consisted of 325,619 males and 318,684 females, with the average population growth 5.18 percent annually. The population density is approximately 21 people per km². The majority of the population is Moslem (99%). The Kampar population is relatively homogenous in terms of ethnicity and religion. Sixty-three percent of the labour force in the Kampar region works in the agricultural sectors (Kampar Statistic, 1999). Rachbini (1996) claimed that the land types and uses reflect the social, economic, and cultural status of a place or a site. Table 6 shows land use distribution in Kampar region.

Table 6. Land Use in Kampar Region

Forest function	Area (Ha)	%
Protection forests	107,804	4.5
National park and recreation	100,771	4.0
Limited production forests	629,527	26.0
Permanent production forests	391,249	16.0
Convertible forests	135,941	6.0
Private/community forests	55,781	2.0
Estate crops	445,592	19.0
Unproductive dry lands	133,017	5.5
Unproductive swamp areas	221,025	9.0
Farming areas	166,875	7.0
Total	2,387,582	100.0

Source: Kantor Wilayah Kehutanan Riau, 1997.

Government policy as described in Regional Act No.45/1992 emphasised that regional autonomy is carried out in the Region. In line with this policy, the Minister of Forestry issued Decree No.87/Kpts-II/1994 that assigns five forestry tasks to the regional authority, namely: reforestation and land rehabilitation, private/community forestry, natural silk management, bee keeping management, and forestry extension programmes.

To execute these tasks, based on the Minister of Home Affairs Decree No.061/950/SJ/1994, the Riau Governor in 1995 established five Second Forestry Regional Offices, each to assist the Head of Regions respectively including the Kampar Forestry regional office that assists Bupati (the Head of Kampar Region) in managing Kampar forest resources. The five new forestry regional offices are responsible to the Bupati, because they are the regional government apparatus. However, they financially still heavily rely on the Ministry of Forestry (MoF)

Kampar region was selected as the study area for the following reasons:

- First, Kampar has the largest area of community forests among the regions in Riau Province. It accounts for 7,676 hectares. Different from the other regions in Riau Province, the three types of community forests are available in this region: community forests established under government project, self-motivated tree planters, and the partnership system. Therefore, tree planters or non-tree planters had the same chance to be included in this study and they were living in the same environment and in similar social economic conditions or a relatively homogeneous culture.

- Second, with the three types of community forests in one region, it was easier to travel around the region to find the respondents in an efficient way.
- Third, considering its forest resources potential, the Kampar regional government is the only region which has stated in writing that it wants to make a priority of the development of community forestry in an attempt to enhance regional economic potential as well as to rehabilitate its forest resources potential. This makes the results from the study potentially relevant to forest policy in the study area.
- Fourth, due to the close proximity to Pekanbaru, the capital of the province, the infrastructure of this region is favourable relative to other regions in Riau. For instance, there are reasonable transportation, health and communication facilities.

Table 7 in the next page shows the distribution of community forestry areas in the Kampar region. The forestry extension workers recorded the data in 1997 based on their field observation. It was divided according to location and the year of planting. The average land size per owner was 1 - 2 hectares. Data recorded by the Riau Forestry Regional Office (1998) shows that some more private areas in Kampar region were planted trees by government projects as well as planted voluntarily as a result of the self-motivated movement. The planted areas were amounted to 850 ha and 475 ha, respectively. No additional areas were planted under company projects after 1997.

Table 7. Total Area of Community Forestry in Kampar Region.

Districts	Government Project (ha)	%	Self-motivated (ha)	%	Partnership system (ha)	%	Year planted
Kampar	0.25	8	62.5	3			1994
	350.00						1995
	250.50		100				1996
Koto Kampar	30.50	8	125	7			1994
	400.25		125				1995
	200.50		100				1996
Rambah	321.00	17	330	24.5	675	40	1994
	500.50		751				1995
	470.50		185				1996
Rambah Samo	375.00	7.7	37	1.5			1994
	100.00		38				1995
	110.00		10				1996
Kepenuhan	170.50	11	125	8			1994
	300.25		172.7				1995
	350.50		115				1996
K. Darussalam	125.00	9		8.5	1000	60	1994
	220.50		318				1995
	350.50		120				1996
Kampar Kiri	50.50	11	125	19.5			1994
	300.25		738				1995
	500.50		150				1996
Langgam	300.00	10.5		5			1994
	300.50		250				1995
	200.00						1996
Pangkalan Kuras	200.00	11		8			1994
	300.25		285				1995
	300.50		130				1996
Bunut	500.50	10	125	7			1994
	275.25		248				1995
Kuala Kampar	105	1.3					1994
Tandun	40.50	7	125	8			1994
	135.25		173.5				1995
	352.50		100				1996
T o t a l	7,591.75	100	5,163.7	100	1,675	100	

Source: Kantor Wilayah Kehutanan Riau, 1997.

1.7 Conclusion

The main challenges faced by Indonesian forestry are forest depletion and a wood supply deficit. It is widely recognised that the forestry policy that has emphasised the involvement of large-scale industry since 1965 has failed to meet the vast mandate given by all the people of Indonesia to manage the forest resources in a sustainable manner to achieve the welfare of the nation. The accelerating forest degradation, deficit in wood supply, the declining environmental quality, and the increasing gaps between social classes is reflection of the failure.

As shown by literature one of the causes of the failure was the centralised management and top-down approach that barred local people from involvement in Indonesia's forest management. This strong centralised forest management in Indonesia was adopted from the colonial era with the intention to monopolise the use of forest resources for the sake of national economic growth. However, forest resources have been used to serve an elite minority and private business interests, and the Indonesian forest policy has not yet been able to support the use of Indonesian forest resources in a sustainable manner.

Learning from its neighbouring countries and realising the local people potential in forest plantation, the Indonesian government is seeking local people's help to ease its forestry problems. Therefore, this research aims at supporting the government's efforts to encourage local people to grow trees on their private lands by presenting an understanding of why they do or do not plant trees

Landowners' decision making regarding tree growing needs to be documented to help the government provide a better policy by emphasising activities that motivate landowners to grow trees as well as removing their constraints. This information is very important for the Indonesian government to understand people's aspirations in CBFM and to enable it to design better plans and policies for better CBFM projects implementation in Indonesia.

Coincidentally, Indonesia was hit by an economic crisis in 1998, which drove the reform movement to emerge and to ask for restructuring policies and implementations to give more attention to local community empowerment. This research is relevant to the current issues of forest management in Indonesia, in particular those emerging in the transition from the old paradigm of economic-based forest management to community-based forest management.

The research uses Riau Province and the Kampar region as the study area because of the potential of its natural forest, its issues of wood supply deficit, and its community forestry development. The use of this province as the study area is also an attempt to assist the MOF to promote CBFM outside Java Island.

CHAPTER 2: LITERATURE REVIEW ON FACTORS INFLUENCING, AND MODELLING OF, FARMERS' DECISION IN TREE PLANTING

2.1. Introduction

Various factors considered as benefits of trees cause many people to rely on trees surrounding their homes. Arnold and Dewees (1997), and Gilmour (1997) argued that in many developing countries, the livelihood of rural people depends on adjacent forests in order to have access to one or more locally important goods and services. As natural forests degrade, there is sometimes a transition in land use. As agriculture expands into degraded forest areas, farmers increasingly maintain or plant trees on their land to keep a continuous supply of tree products. Arnold (1997) claimed that there are few farming systems today that do not incorporate trees. However, until recently, tree resources in farm landscapes had attracted very little attention. Agriculture services were concerned only with those tree species that had been adopted as agricultural crops. Forest service focused only on trees within areas defined as forests. Falling between the two, tree stocks maintained by farmers remained unnoticed. Experience with programmes to provide support to smallholder tree growing shows that the results are varied. Some have resulted in significant increases in tree resources, but many programmes have failed. (Cernea, 1989; Rao, 1992; Chipika and Kowero, 2000; Sunderlin et al., 2000).

The goal of this research is to understand the needs of those whom the Indonesian Ministry of Forestry (MoF) or rural development agencies want to encourage to plant trees. Understanding needs includes identifying and understanding the reasons why people are engaged in tree planting activities on their own farms. Therefore, two interrelated parts are outlined in this chapter. First, this chapter reviews studies that have as their main focus the factors that influence people to include or to exclude trees from their farming strategy. Second, since this thesis examined decision making, this chapter also examines international and Indonesian studies that focus on how landowners or farmers include the factors relating to tree planting in their land use decision-making processes. The general point of this chapter is to examine what is known about why landowners or farmers decide to plant trees and how to understand their decision making.

2.2 Factors Influencing Farmer Decision Making to Plant Trees

The main task of this review is to understand why people decide to plant trees by examining reasons for and constraints against tree planting. Reasons for tree planting vary depending upon the needs of those who do the planting and in general planting trees as part of farming systems has its origins in three attributes of trees, physical environmental maintenance, economic values, and socio-cultural values. First is the role of trees in maintaining the physical environment that is needed to sustain agriculture. Trees can be used as inputs to agriculture or substitution for purchased farm inputs such as fodder, mulch, live fencing, green manure and raw materials for making agricultural implements and storage structures. Second is the role of tree products in contributing to household economy. For instance, tree products are used directly by the household to satisfy subsistence needs such as food, fuel, construction materials, etc. Trees also provide household members with commercial opportunities to supplement employment and provide cash income. Government policies to encourage wood-product markets and to provide incentives can attract people to plant trees. Aside from its advantage as farm assets physically and economically, the third attraction to plant trees is due to their social and cultural values, including using trees as a way of securing tenure and traditional attitudes toward trees. The three attributes of trees are used to structure the following presentation of literature drawn from studies in a number of countries. A final sub-section focuses on constraints to tree planting.

2.2.1 Physical environment maintenance

Many studies prove that the advantages of trees in maintaining farm productivity have attracted villagers and farmers to incorporate trees in farming systems. Below are a few examples of how important trees are from a farmer's point of view in the light of soil fertility and conservation. Jodha (1997) and Chambers et al. (1989) examined change in an arid region of western Rajasthan (India). In this region, people have historically based their livelihood on production of grain in association with nitrogen-fixing trees, on livestock management, and on retaining a substantial part of the lands as common property to ensure a reserve biomass product for use in low rainfall years. As population pressure increased, rapid depletion of the area of common land and overexploitation of the remaining resource, forced people to have private trees. Traditionally, farmers in this region planted trees as a form of insurance, for use in times of severe drought. However, such strategies for risk management have unintentionally been undermined by economic measures. With improved access to urban markets, trees have increasingly been cut for sale as timber or fuelwood.

In Pakistan (Sheik, 1989) and in Nepal (Carter and Gilmour, 1989) another attraction of the use of nitrogen-fixing trees is their ability to restore agricultural soils, with side benefits of fuelwood and fodder. On-farm tree growing took a variety of forms. It ranged from not destroying naturally growing tree seedlings, to protecting them, or to planting them (Michie, 1986). In selected districts such as Baluchistan, Northwest Frontier, and Punjab provinces the trees did not occur in the pattern or places familiar to orthodox foresters (Gold and Gujar, 1989), but they abound in all graveyards and religious places, where they provided shade for eternal blessings for the planters. Prohibition against tree felling in such places was strictly followed (ibid). Trees were found within the enclosed courtyard of every rural home in Pakistan and Kenya (Dove, 1997; Warner, 1997) where they provide shade, fodder and fruit. The greatest numbers of trees were found on the farmlands themselves: in clusters around waterholes and tanks, where the planted banyan (*Ficus bengalensis*) provided the motive force. Hedgerows along field boundaries provided protection against the wind and against livestock incursions, soil erosion, and yielded fuel and fodder.

Trees play their roles even in the most intensively cultivated system (Young, 1989; Warner, 1991; Nilsson, 1995). Thus the tree components of the highly productive multiple species home gardens of the wet tropics help to maintain soil nutrients and soil structure. The above authors agreed that trees also create a microenvironment within which other plant or animal components can survive, as well as contributing directly to the farm production such fruits or other subsistence and commercial products that eventually support farmers' economic life.

2.2.2 Rural household economy

This research found that most of the smallholder trees growing in the study area were grown by subsistence farmers with an average landholding size of approximately two hectares. It supports Simon's (1995) prediction that tree farmers in Riau would plant trees if they can mix the trees with their other seasonal crops that they rely on to survive. One of the attractions of planting trees is the ability of trees to be integrated into rural livelihood strategy where rural people use trees to contribute to their economic activities.

Theories of 'livelihood strategy' are derived from earlier theories about 'household economy' and 'household decision-making' from economists such as Baum and Schertz (1983), and Singh et al. (1986) and from economic anthropologist Barlett (1980). Rather than assuming that farmers are profit maximisers who act only based on profit orientation, these theorists focus on 'welfare maximisation' that reflects multiple household objectives, including secure food and subsistence goods, cash for purchase of outside goods and service, investments or savings

(resources accumulated to meet future planned needs or emergencies), and social security for instance secure access to subsistence goods and productive resources (Scherr, 1987; Shukla, 1993). While seeking to meet these objectives, the farmers also seek to reduce risk factors (Christanty et al. 1985; Holden et al. 1991).

In turn farmers' livelihood strategy and resources determine tree-growing strategies (Rocheleu, 1987; Holden, 1988; Belsky, 1993; Malla, 2000). Farmers may be keen to grow timber trees for saving if they have no superior strategy for savings, while they reject growing trees for cash income if they already have a successful strategy for earning cash income from off-farm jobs or from other crops. Farmers with many family members of working age may be little interested in farm fuelwood production, while those with little household labour may place a higher value on time saved from fuelwood collection. In western Kenya, families with many children still at home placed emphasis on food security, as well as regular cash income to pay school fees. With more abundant labour resources, they can adopt more labour-intensive agriculture practices (Saxena, 1992; Scherr, 1997, Salam et al., 2000). Older farmers, meanwhile, whose children are grown, more often opt for lower labour demanding activities such as woodlots and border plantings for poles or homestead plantings (Nilsson, 1995). Blowfield (1995) studied cocoa production in Ghana and rubber production in Sumatra, Indonesia. He found that strengthening family networks by recruiting more extended family members is a deliberate strategy to manage farms. Simon (1995) observed that owing to difficulties in controlling the land, farmers in Java, Indonesia tend to plant their far distant land with trees. Arnold and Dewees (1997); Salam et al. (2000) concluded that in Africa and India farmers with larger farm sizes favoured the use of commercial, fast-growing trees such as eucalyptus. These trees were marketable but led to serious farming yield declines when planted adjacent to food crops. On smaller farms, trees were planted only with greater interest in soil fertility and protection.

Therefore livelihood strategy appears to be an important process that influences landowners' decisions to incorporate trees into the farming system. Decision-making regarding tree planting is not simply farmers responding to different factors or making a profit, but for subsistence farmers it relates to the fundamental principles of living. Farmers wisely consider whether the presence of trees on their farm not only could satisfy or guarantee their subsistence needs, but also could improve their lives. It also includes how landowners and farmers consider using their available assets and capital. They include land, labour, and money for growing trees, and how they use trees as a response to employment opportunities or alternatives that enable them to increase their standard of living such as proximity to the labour market in urban areas.

Rural household subsistence. In many cases, tree planting is motivated by basic household needs. For the majority of rural people, fruits and other forest foods add variety to diets, improve palatability, and provide essential vitamins, minerals, protein and calories. The quantities consumed may not be great in comparison to the staple foods, but forest foods are often valued as snack foods commonly eaten, especially by children while working in the field, while herding and while gathering fuelwood. In addition fuelwood is the main source of energy used for rural cooking (Campbell, 1987; Arnold, 1990).

Perhaps a less obvious, but very important, role of trees is as an economic and environmental buffer for the majority of rural people. Trees can be a source of food, materials and income that help people in hard times or when other options fail. More widely, the use of gathered forest products tends to increase as agricultural production declines (Chambers and Leach, 1987; Meadow, 1999). As forest resources disappear or are degraded, farmers have tended to shift the selected forest outputs of value to their own land by protecting or planting tree species (Gilmour, 1988; Jodha, 1991). Observation in two districts in central Nepal (*ibid*) indicated that farmers normally kept the main cultivated parts of their farms free of trees, but allowed trees to regenerate naturally (or planted them) on the edges of farms or slopes. This situation also applied in Western Kenya (Scherr, 1997) where on-farm tree planting became more intensive with the transition to permanent cropping and the disappearance of communal tree resources. Reasons for tree planting in Pakistan (Dove, 1997) were dominated by the domestic needs of local people for fuelwood and timber for construction. Farmers in eastern Kenya preferred multi-purpose trees, which provide fruits, timber, fuel and fodder (Warner, 1997). When the forest resources become scarce, trees were also more cultivated on land close to the house in central Nepal and Taiwan to make leaf collection for feeding animals easier (Gilmour, 1997; Jen et al, 1997). Table 8 depicts how forest resources scarcity influences people's attitudes to trees.

Table 8: Responses of Tree Farming to Forest Resources Scarcity (after Gilmour, 1990)

RESOURCE	LOCAL INTEREST	RESPONSE
Ample forest adjacent to village.	No interests in tree planting or forest protection	Indigenous management systems exist, confined to defining use right only
Forest becoming depleted or access restricted or getting far from home.	Emerging interest in forest development activities (or potential for extension).	Indigenous management systems exist to define use rights and in some cases have biological objectives. Few trees on private land but interest beginning.
Severe shortage of forest products.	Genuine interest in forest development activities or tree planting. Little need for people to be convinced by extension.	Indigenous management system well developed and defines both use rights and biological objectives. Extensive private tree planting and protection likely.

Employment and income opportunities. The previous sub section showed that the primary motive or attraction of tree planting has been to achieve rural household self-sufficiency. In addition, trees can also be attractive as a source of capital and alternative household income (Blair, 1990; Scherr, 1992). Further, with improving rural road infrastructure, market demand for tree products such as fruits, poles and fuelwood is becoming a factor encouraging the growing of trees, and this is likely to increase as access to markets improves. Increasingly, farmers are likely to select tree species for their potential income value rather than purely for trees' ability to supply immediate household needs (Arnold, 1997; Scherr, 1997). Government policies that focus on small farmers as the producer of tree products for the nation encourage smallholder tree planting.

Arnold (1991) and Scherr (1995) demonstrated that the most important lesson to emerge from evaluation of one aspect of a social forestry programme in the Indian states of Tamil Nadu, Orissa, and Bihar, and western Kenya was that farmers can and will grow trees for economic reasons. A market must be available if projects encouraging trees as cash crops are to be successful. Forests and trees enhance economic access to food by providing substantial cash income and jobs. Tree planting is only a viable option if appropriate markets are accessible and tree tenure conditions are stable (Hoskins, 1990).

Blair and Olpadwala (1988), learning from Gujarat Social Forestry, found that people were motivated to grow trees among both community forestry groups and individual farm forestry for commercial sale. He also noted that India's Social Forestry Programme had failed to dramatically improve the rural fuelwood supply, which was one of its stated goals. However, rapid expansion of planted areas has resulted from farmers' commercial interest, which is to market poles and timber. Molnar (1986) argued that the most disappointing aspect of the woodlot experience in India has been the lack of active involvement by local people. In some cases this is due to inadequate sizing of woodlots in relation to community needs, resulting in individual returns that are too small.

Creating a stable market for timber and guaranteeing wood prices are the key elements of the successful strategy used in the Pulp Industry Corporation Project (PICOP) in the Philippines (Development Bank of the Philippines, 1981 in Simon, 1997). However, Jones and Campos (1983) in Foley and Barnard (1984) argue that in Costa Rica, farmers were reluctant to grow trees for fuelwood although there was a strong market for fuelwood because sugar cane and coffee provided a financial return eight or more times greater than that from fuelwood.

Foley and Barnard (1984) concluded that whether or not people plant trees depends upon the detailed local economics or market forces. Farmers will continue to join the scheme, or plant trees independently, until it is evident to them that the market is becoming saturated and prices are likely to fall. Arnold (1987) notes that the growth in tree planting by farmers in many situations is in response to production for cash rather than subsistence. A New Zealand study by Fairweather (1995) suggested that economic factors play an important role in farmers' decision-making regarding tree planting, but was not the only factor. Warner (1997) observed that in eastern Africa, farmers were likely to select tree species keeping in mind their potential saleable value rather than purely for their ability to supply household basic necessities. Murray (1983) in Foley and Barnard (1984) said:

No matter how technically sound the programme offerings, no matter how ecologically suited the particular tree to the particular hillside, if the tree is viewed by the farmer as negative to his cash-flow interest, the tree will be firmly rejected.

This supports Hardjanto and Kusnanto (1995), and Simon (1995b) who argued that those villagers in Java, Indonesia established community forests because the products were marketable. So he suggested that villagers outside Java might do the same thing for a similar reason. However, he stressed that conditions inside and outside Java were different in terms of culture, needs, the way of thinking, infrastructure, population density, soil fertility, employment, total land possession, climate, etc.

Dove (1988), based on his experience in Kalimantan, Indonesia, insisted that local people will devote their time to planting trees (*Hevea brasiliensis*) and managing them for commercial purposes only when their subsistence needs are fulfilled. Simon (1995a) evaluated the greening programme in central Java. The programme successfully encouraged villagers to plant trees on their private lands. However, the species that were provided by the government are no longer found in the area. He concludes that the local people, given time, can wisely choose species that are culturally and socially acceptable and also marketable. Wiersum (1994) said that the Leucaena-based farming system in east Indonesia was originally intended for soil fertility and protection from erosion. However, he found that the farmers' motives for adopting this agroforestry programme were food production and cash crops.

Therefore, learning from the above review, market for tree products should be available if any government wants to see people growing trees on their own land. Policies and encouragement that enable tree growers to market their trees are very important in developing community forests.

Encouragement and government policies. The previous sub-section shows the importance of market availability as an attraction for tree planters; this sub section gives an idea how encouragement and government policies related to the wood market have supported people in planting trees. Burch and Parker (1992) supported an Food and Agriculture Organisation (1985) report that the Indonesian government (GoI) was originally of the opinion that rubber plantations (*Hevea brasiliensis*) could only be properly cultivated in large estates. Nonetheless, swidden cultivators quickly incorporated rubber trees into their system, partly because of high rubber prices, but also because of encouragement and seed supply from Chinese traders. Learning from local knowledge, and the interaction between the growers and the local traders, the GoI was actively promoting smallholder rubber cultivation (ibid.). Recent studies indicate that some swidden rubber cultivation practices in Indonesia have been found to be superior to rubber plantation management practices under government supervision (MoF, 1999). Drawing lessons from this case, Burch and Parker (1992) concluded that the elements that fuelled adoption of the new practices included price/market, encouragement, inputs (such as seeds), and the experience of farmers.

The supportive government policy to encourage tree planting includes providing incentives such as soft loans and free seedlings. Hyman (1993) noted that the Philippines government used a soft loan from the World Bank as an incentive to increase the number of people involved in a tree-farming project in the Philippines. Initially the project was able to attract many tree planters. However, he also noticed that the project has failed to achieve further development due to the defects of government policy such as the dictated tree species, numerous paperwork requirements for participation, increasing the soft loan interest rate and the requirement of labour inputs.

The Indonesian government (GoI) through the greening programme claimed that in a five-year period (1991-1995) it was able to mobilise local people to plant trees on 760,000 hectares of logged-over areas throughout the country. The GoI supplied free tree seedlings, gave technical assistance and tree planting equipment, and provided planting wages for the participants (MoF, 1995). However, Simon (1995a) argued that the greening programme in Indonesia did not achieve the expected results, as this programme was not able to meet the social and economic needs of those involved. Further Hyman (1984) and Shah (1992) concluded that government encouragement does not always result in more people planting trees. They showed that in some Asian countries, the policies which were expected to attract tree farmers have discouraged people from participating because credit, loan, and subsidy facilities were limited to a certain group of farmers. This caused many others, especially the small farmers, to give up tree growing.

Shah (1992) also reported that extension and communication institutions in some governments were fragmented and were not able to communicate information about government benefits for tree farmers. These mistakes resulted in many tree farmers in Asian countries lacking the technology, funding and information needed to grow trees, which eventually discouraged them from planting trees although they had adequate land to grow trees.

Land and labour availability. Dove (1997) and Malla (2000) argued that an important determinant of the relative attraction of using land for trees as opposed to other purposes involves the capabilities of the land. The ability to use the land for purposes other than growing trees or the ability to use the land for tree cultivation at the same time as it is used for other purposes (especially food crops) is central to interest in tree growing. This is reflected in the fact that one of the landowners' concerns regarding tree cultivation is the impact of cultivation on annual crops. Farmers worry about tree crop competition not just with respect to soil nutrients, sunlight and water, but also with respect to human labour. Farmers say that whenever tree planting competes for labour with cultivation of annual crops, they will sacrifice working with the trees in order to work with the food crops.

Interest in tree cultivation tends to be higher therefore, on land that is not suited for food cropping such as non-arable land or wasteland. Land may be unsuited to food cropping, and thus suited to tree cropping because of problems of erosion or simply lack of water especially in arid or semi arid countries (Dove, 1997). Arnold (1997) classified trees on non-arable land as likely to occur in more extensive farming or grazing systems in which trees are naturally regenerated. Gilmour (1997) reported that in three villages of east Kathmandu most trees were found on non-cultivated patches. Mehl (1990) and Rademaker (1990) identified in central Java, that farmers mostly planted trees in relatively marginal areas with multipurpose intention.

Mehl (1991) refined the view of the importance of land availability in influencing farmers' decisions by saying that the size of the farm affected the ways a household used tree products. In Southeast Asia, medium- and large-farm households used tree products as their primary source of fodder more often than that of small-farm households. For all farm size groups except landless households, the household farm was the primary source of fuelwood. However, small-farm households used state forests as a major source of fuelwood much more frequently than that of medium or large-farm households. Medium and large-farm households were more likely than small-farm households to use timber regularly, whether for sale or for domestic use.

In western Kenya, the relationship between wealth rank and tree densities was inverse (Scherr, 1997). Poor farmers had higher densities of trees per ha than the average or the wealthy farmers. This finding reflects differences in access to farmland, with wealthy farmers having more land uncultivated. In contrast, Dewees and Saxena (1997) argued that in Uttar Pradesh, India, a survey of four villages found that operators of larger holdings were more likely to plant trees than operators of smaller holdings. Among both large and small farmers, upper caste households planted more trees. These findings are of particular interest, especially when considering the fact that small farmers followed a cropping pattern and used similar levels of inputs, such as chemical fertilisers, as large farmers.

Woodlot planters in Uttar Pradesh also had several times more land, assets and non-agricultural incomes than other tree planters or non-tree planters. Small farmers who were woodlot planters also had substantial assets, compared with other small farmers. Wealthy landowners in the Punjab and Haryana (India) planted more eucalyptus in their uncultivated land with a view to gain commercial benefit due to the development of the construction poles market (Dewees and Saxena, 1997). Marawar et al. (1993), Knudsen and Madsen (1999) agreed that the majority of tree farmers in Vidarbha District, India as well as in Pakistan were graduates, belonging to high castes and to the business society. Most of them were absentee landowners, had agriculture as a sub-occupation and they were mainly engaged in some business and other enterprise with strong economic base. The likelihood that a household would establish a woodlot was greater with the more land the household operated, the greater the extent of its assets, and the more diversified its sources of income. These factors combined to ensure that households would have alternative sources of income until trees could be harvested and sold.

On the other hand, learning from her study in eastern Africa, Warner (1997) argued that labour availability is the factor that has most impact on tree-planting decisions. The out-migration of young males is a constraint on the cultivation of the existing land. Even where farm sizes are very small, households suffer shortages especially during seasonal peaks in demand for labour. This finding is in line with Poel and Dijk's (1987), and Dove's (1997) arguments that proximity to a labour market has an impact on land use decision-making.

Proximity. Poel and Dijk (1987) and Dove (1997) found that the location of the village affects the attraction of the landowners to grow trees as opposed to using land for seasonal crops, for grazing, or for nothing at all. The closer the land lies to state forests, from which tree products can be taken, the lower the interest in tree cultivation. Also important is the proximity of the village to roads and towns. The greater the proximity, the lower the interest in tree cultivation tends to be, because villagers usually are more involved in off-farm income-producing activities and less interested in the kind of investment in their land that tree farming represents.

Widianto (1997) supported this finding by emphasising that urban wage labour opportunities in West Java, Indonesia caused replanting efforts in state forest areas supervised by Perhutani (State Forest Enterprise) to lack participants, and less trees to be planted. Increased infrastructure development enabled them to get easier access to off-farm jobs so they do not have time to plant trees. However, Michon (1994) and Gilmour (1997) claimed that urban wage labour opportunities might have the opposite effect. Off-farm job opportunities lead to a shortage of agricultural labour in the village, but this situation increases the attraction of trees because growing trees require less labour so they have more time for the off-farm-jobs. Trees also require low inputs, less establishment cost and yield higher return than seasonal food crops. Dewees and Saxena (1997) found in Tamil Nadu that many poor farmers converted their seasonal crops to eucalyptus and cashew nut plantations, because they could better survive in prolonged dry periods, and that later allowed poorer households to seek wage employment elsewhere. This sub-section on rural household economy has reviewed subsistence needs, employment, market opportunity, government policy, available assets, and proximity to show that farmers include and exclude trees in their economic activities and livelihood strategy in order to survive or to increase their household income. Government policies to support tree planting should be appropriate to the need of tree planters; otherwise, they may cause negative effects that discourage people from planting trees. Trees also would be planted on land where it is not suited to food crops, and farmers will use their labour to plant trees as long they do not use it for food crops to which they give higher economic priority. Farmers would not plant trees if they prefer to use their time for wage labour outside the farm; but, they would plant trees if they consider that their farm need to be attended while they were away for labouring jobs. Farmers who have more assets such as larger land size and money would plant more trees, and they tend to plant trees for a profit. However, economic variables are not always the only factors influencing people's decision to plant or not to plant trees.

2.2.3 Social and cultural attitudes

Tree cultivation is also influenced by a variety of social and cultural attitudes toward trees. Some encourage tree retention or planting while others discourage active management. In some countries, trees are planted to secure rights and land tenure. Religion and cultural tradition in some places strongly influence villagers to plant or not to plant trees. Gender and labour division affect how people in certain places value trees.

Securing rights and land tenure. Traditionally, systems of customary tenure have recognised rights of use of the products of trees that are independent of the usufruct rights to the land (Fortmann, 1987; Raintree, 1987). However, as customary tenure landholdings become recognised as 'belonging' to an individual, distinctions between tree tenure and land tenure will probably decline and rights to trees will become intertwined with rights to land on which the trees stand (Migot-Adholla et al. 1990).

In the Bimodal Highland zone, eastern Africa for instance (Warner, 1997), trees and land tenure are becoming identical. The planter of the trees is recognised as having rights to the tree, but trees are usually only planted on land to which the planter has pre-existing rights or for which rights will be established once the trees are planted. However, his rights to the tree weaken if the planter no longer farms the land. Further Warner (1997) said that the right of exclusion, specifically the rights of a farmer to exclude livestock from grazing on the household's fallow fields appears to be more important for tree planting than the right to farm.

In most rural areas in developing countries, households are experiencing growing dependency on off-farm income, as more men seek work outside the homestead. Labour markets in urban areas and the increased demand for cash income force landowners to be move away from or abandon their lands. Dewees (1990) found in the Bimodal Highlands of Kenya that people planted trees to keep their land under their rights particularly when they were far away from their villages.

Tree planting was only a viable option if appropriate markets were accessible and tree tenure conditions were stable (Hoskins, 1990). Chambers and Leach (1989) argued that low establishment costs, high rate of appreciation under higher rainfall conditions, alternative investment, and regeneration potential are advantages of trees. Insecure tree rights, heavy state involvement and low prices are common disincentives to tree planting. The authors argue against always promoting tree-planting projects on a common ownership basis because private ownership provides more secure long-term benefit to the poor than common ownership arrangements, which are often usurped by the local elite. It also has been argued that insecure property rights dissuade farmers from undertaking investments with long gestation periods because they cannot be sure of reaping the benefits (Foley and Barnard, 1984; Arnold and Stewart, 1991; Hardjanto and Kusnanto, 1995). However, one specific finding of a study of twenty-one agroforestry projects in six Central American and two Caribbean countries is that lack of land title does not appear to be a significant constraint to agroforestry adoption in these areas. The important point is how secure farmers feel about their property rights with or without title. Often, even without an official title, *de facto* property rights provide the farmer with enough security (Current et al., 1995).

Wiersum (1999) found that in east Indonesia several farmers were attracted to participate in the *Leucaena*-based farming system programme because of the advantages of trees as land tenure. The farmers planted the provided trees on state land with the intention of claiming the land where the trees grow as their property.

Religion and cultural tradition. In Zimbabwe and Northern Cameroon people are prohibited from cutting certain sacred trees (Wilson, 1989; Olson, 1999). Such beliefs also occurred in Riau, Indonesia and made villagers reluctant to cut certain indigenous trees (Hamidi and Ahmad, 1993). On the other hand in Zambia the planting of indigenous trees was culturally discouraged because it was perceived that only God can plant trees (Kwesiga and Chisumpa, 1990). In Kenya, villagers also had a similar attitude toward indigenous trees. However, since this constraint was only on the planting of indigenous species, farmers were still free to plant exotic trees (Feldstein et al. 1990).

Farmers were responsible for the changing farm landscape in the Terai, Nepal. Most farmers came from the hills region (Gautam, 1993); therefore, they have a strong culture of trees on farmland. For these people farmland has traditionally had a number of functions. When they found that the supply system in the Terai had no provision for satisfying their needs from the forests (the supply system in forestry products has been developed mainly for urban areas only), then farmers were motivated to plant more trees on their farmland.

Gender. The cultural division of labour between men and women can also help account for the fact that farmers rarely choose to plant trees only for fuelwood, since it is traditionally women who assume responsibility for gathering fuelwood, while men are responsible for construction materials and certain cash needs of the household (Deweese, 1997). Hence men place a higher priority on species that can provide income and building materials. This is supported by the fact that in some regions in India and Kenya where men become involved in fuelwood collection (if the supply is distant, the fuelwood is transported by men), they show greater interest in planting trees that can among other things, provide fuelwood (Singh, 1991; Scherr, 1997). Women in those regions are usually recognised as users, not the owners of the resources. Permission to use a resource is determined by women's relationships to males in the community, usually fathers or husbands. Therefore it is the man who holds the right to make decisions about planting trees. However, women as well as men can, and do, plant trees, especially fruit trees, in homestead areas. Since women are responsible for providing food for the household, a fruit tree planted in the homestead or home garden affirms a woman's rights and responsibilities, just as a tree planted in a crop field or boundary affirms a man's rights to control those resources.

Scherr (1997) and Olson (1999) also found in Northern Cameroon and in Kenya that the average number of trees on farms was significantly higher among households that were male-headed. These men have both the interest and authority to plant trees, and operate a larger farming area. Women without husbands had the fewest trees.

This sub-section shows that even without secure land ownership, people still plant trees and believe that they still have the rights over the planted trees. In some places, having rights over trees also provides rights over the land where the trees are grown. Therefore, some tree planters use trees to get access to government land and claim the cultivated land as theirs. With the advantages of trees such as low initial costs and being easy to maintain, trees are often used as a way to show land ownership. This sub-section also shows that the advantages of trees for human life, religion and tradition are factors that encourage people to respect and retain trees. However, this attitude is still limited to natural trees, and it has not yet been extended to plantations. With respect to gender this may influence people to plant trees, and when considering the benefits of trees, it is clear that men are more interested in planting trees. Since women are more responsible for working to meet daily needs, a long period before receiving benefits might cause women to give trees low priority. Along with two earlier sub sections, this sub section has covered a wide variety of reasons for tree planting. However, there are also constraints against tree planting that cause government or aid agencies difficulties in promoting tree growing on private land.

2.2.4 Constraints on tree planting

Some farmers in New Zealand rejected trees because trees took land out of grazing, had a long gestation period that tied up their money for 40 years (slow return), and because they felt uncertainty about how they would reap the benefit (Murray, 1986). In Wales, Thomas and McLean (1984) found that the possibility of increasing the incidence of foxes and other pests caused farmers to view trees negatively.

Dove (1997) found that lack of water, threats and space competitors against food crops, lack of seedlings, sources of pests and diseases to food crops, and soil problem are the constraints for tree planting in Pakistan. Hyman (1993) noted that in the Philippines people refuse to plant trees because of lack of capital to establish adequate woodlots, problem with tending costs, and market uncertainty. Saxena (1992) argued that inability to implement a proper plantation management constrained north India farmers to plant trees for timber production, and Salam (2000) confirmed that lack of economic benefit prevented Indian farmers from planting trees.

As pointed out by Foley and Barnard (1984); Wilson (1989); Cossalter (1996); Dove (1997), and Scherr (1997) people may have a number of reasons to feel that growing trees will do them more harm than good, even on their own lands. The greatest obstacles to tree growing may be simply that farmers do not regard it as a priority. This is particularly the case where tree growing is difficult and conflicts with the household resources needed for crop production.

There may also be a variety of legal constraints to tree growing. In some countries, e.g. India, Thailand, the Philippines and Burma, the government owns all the trees, whether they are on private or public lands. People have no rights to cut trees, even if they planted them themselves, without going through the lengthy process of obtaining official permits. Policies of this kind, which are designed to protect forests, can discourage tree growing. Understanding why trees are not grown by people who own sufficient land for growing trees is a most important step in policy-making on community forestry (Foley and Barnard, 1984, Peluso, 1992).

This sub-section has shown that factors that discourage people from planting trees are not only lack of a wood market or less opportunity to make profit from trees, but there are various types of constraints on tree planting that cause people to be reluctant to incorporate trees in their farming system. The constraints vary from place to place. Therefore, if people in a particular area need to be encouraged to grow trees, their constraints on tree planting should be clearly understood.

Section 2 of this chapter has reviewed the wide variety of factors that influence decision-making regarding tree planting. The combination of economic, demographic, social, political, and resource availability factors influence the outcome of how farmers manage their private farmland. As far as trees are concerned, it is clear that farmers have been involved in a process of rearranging the trees on the resources under their control to suit their needs at any particular time. These needs will change from time to time and the response of farmers will also change over time. The outcome may vary from place to place depending on the overall balance. The important point that emerges from this review is that the processes are highly dynamic, and the governments and aid agencies need to understand this if they wish to intervene successfully with forestry and agroforestry projects. Lack of understanding or misinterpretation might lead to unwillingness of people to continue their involvement in tree-farming projects. Remaining to be examined is how all the different factors relating to advantages and disadvantages of trees are incorporated in landowners or farmers' decision-making processes.

2.3 Decision Making in Tree Planting

The previous section discussed existing studies of the important factors that determine farmers' decision to maintain, protect or to plant trees in their farming strategy. This section examines how farmers assess these factors and include them in their decision-making process to meet their life objectives. It is the position of the thesis that in order to establish an understanding of how tree management could be included in farmers' strategy, factors that attract farmers to decide to plant trees and how farmers incorporate these factors in their land use decision-making must firstly be understood. Land use decision-making relates to farmers' responses to pressure to adapt their use of land and other resources according to the changing circumstances. It includes how farmers use their land and other resources to grow trees, or how farmers incorporate trees into their land use decision-making.

As land use decision-making is the focus of this chapter, therefore, the main task of this review is to understand how research and studies either international or Indonesian have approached and examined farmers' decision-making. Attitudinal measurement and modelling are research tools that are frequently used to examine farmers' decision-making. Modelling farmers' decision-making is distinguished by two different perspectives, economic and non-economic modelling. Economic modelling usually uses quantitative methods, while non-economic modelling commonly uses either quantitative or qualitative methods. Therefore this section is divided into two sub-sections, the first reviews studies that approach farmers' decision-making either through attitudinal measurement or using modelling, and the second reviews cognitive versus statistical models and their respective advantages to develop understanding of farmers' land-use decision-making.

2.3.1 Approaches to farmers' decision-making

Decision-making involves the evaluation of different options, usually followed by an assessment that one option is preferable. The decision-making process of farmers involves a range of factors that are taken into account. Each farmer usually makes choices within the context of the household and is influenced by the household's needs and goals as well as by the resources available to the household. These resources not only include cash, land, water, labour, etc., but also social resources such as information about agricultural methods or credit, extension and training, and any influence or political power necessary in many areas to successful agricultural practises and production (Barlett, 1980, Geilfus, 1997).

Barlett (1980) and Sorensen et al. (1996) argued that to understand agricultural decisions, the approach used to measure how farmers balance the costs and benefits of alternative choices is crucial. However, the required quantification of all the costs and benefits that farmers weigh is difficult. It also has been shown that the process of estimating opportunity cost can misrepresent farmers' decisions by ignoring important criteria in their assessment of different non-economic opportunities. For example: households may forego certain profitable agricultural options to invest resources in a social institution, which often act as buffers against risk. These "social constraints" are often seen as "non-economic" factors, although, in fact they may have important economic roles. With multiple goals for each household, complex resources mixes, and the diverse characteristics of the choices being considered, estimations of opportunity cost often may be more an expression of researchers' values than an estimation of the behaviour of the people under study.

The principle of rationality, one of the cornerstones of economic theory (Cohen, 1967), states that human beings, if given enough information, will seek to maximise their gains by obtaining the highest possible return for any given resource, and they will seek to economise (minimise) the smallest quantity of resource they have to obtain a given return. The concepts of rationality, maximisation, and minimisation commonly are used in social science discussions of economic choice or decision-making. However, Chibnik (1980) and Johnson (1980) argued that even if people wish to maximise (or minimise) a particular goal and know all the relevant information, they will usually still be unable to do so.

Brase and La Due (1989) in their review of factors influencing farmers' investment decision-making observe that researchers adopt either an economic perspective or a socio-economic perspective. Economic models of investment decision-making typically use rational models using price and other quantitative variables in equations in order to predict the behaviour of decision-makers under various circumstances. Proponents of socio-economic models attempt to integrate all non-economic variables including age, education, farming experience, ownership, land size, farm type etc. Further, Johnson (1980) described the common difference between economics and sociology as the preference of the economist for formal prescriptive models and the sociologist or anthropologist for broad-ranging descriptive models. Economists use arguments in mathematical-deductive forms that in many cases are not tested against empirical data. They are often interested in determining and suggesting how people maximise returns given specified goals and constraints that are often very complex and suitable only for business enterprises. Therefore, they are interested in normative problems, not description. In contrast, sociologists or anthropologists are interested in the descriptive end of things, that is, in understanding what people do and why they do it. They use ethnographic descriptions of

individual cases constructed together by loosely theoretical explanations. Ortiz (1979) asserted that in making land use decisions, farmers' calculations are not set out as multiplication problems of expected yield range and expected price range as commonly suggested by economists', but what returns they have experienced so far, and which ones are more likely to be repeated. She joined Johnson (1980) and Barlett (1980) who criticised the use of economic concepts of maximisation, choice, and efficiency for not adequately describing actual behaviour, and instead calling for ethnographic interpretations to make economists' models work.

More than three decades ago, Salisbury (1968) reported that the major issue in economic decision-making at that time was to determine to what extent formal calculations of rationality could be isolated in non-western societies. Several years later an increasing number of scholars questioned the usefulness of this approach to analyse economic behaviour. Convinced that real life choices seldom estimate optimally, they used ethno-scientific methods to study how individuals actually made economic decisions (Johnson, 1974; Gladwin and Murtaugh, 1975; Quinn, 1978; Chibnik, 1980). This is a different way of studying economic decision-making that does not require assumptions of complete rationality of economic actors. Further, many anthropologists felt that statistical analysis carried out by sociologists and economists displayed insufficient concern for cultural context. In this view, to explain statistically significant differences between groups, social scientists must consider more than just quantitative data. Such examination should be theoretically informed, and can involve interviewing people, participant observation, examining historical sources etc., methods that are widely known as studies of natural information.

The study of natural information processing in agricultural decision-making is important because it focuses attention on the farmer actually making the decisions and avoids externally imposed normative assumptions. Natural information wrapped in cognitive models has proven to be an accurate predictor of individual choice in a number of agricultural settings, and thus it has empirical power. The importance of cognitive models in farmers' decision-making is more than translating farmers' behaviour from the field to research formats, it is the local knowledge that farmers bring to research topics like trees, agriculture, forest or farm forestry (Gladwin, 1980; Messerschmidt, 1992). Cognitive models in decision-making processes are now widely recognised in many disciplines. The underlying theory behind these models is that, people have the ability to report on real-life decisions in terms of alternatives evaluated, dimensions of contrast (and their relative weights) and sequencing comparisons, and they produce a certain pattern. People, in choosing alternatives, do not make complex calculations of the overall utility of each alternative. Rather, people tend to use procedures, which simplify their decision-

making calculations, due to their inability and/or unwillingness to process all information available to them. These models are not only knowledge, but also understanding and application to work for development (Gladwin, 1989; Messerschmidt, 1992). Tversky (1972) and Slovic et al. (1977) noted that psychological research indicates that when people perceive, process, and evaluate the probabilities of uncertain events they are not 'intuitive statisticians' but instead use simplifying heuristic models and may persist in using them despite major information processing deficiencies. Allison (1971) made a similar point about decision-making in foreign policy. Gladwin (1976), a scholar studying the process by which farmers decide whether to adopt new technology, also noted that people do not make complex calculations of the overall utility of each alternative but use procedures that simplify their decision-making calculations. Barlett (1977), and Quinn (1978) made the same point as Gladwin. Cancian (1979) and Acheson (1980) also argued that villagers or small farmers do not need a complex set of economic concepts to calculate profit. They simply add up all their cash expenses for a day or week (ignoring family labour costs, IRR, taxes and depreciation), and subtract this from cash revenues received in the same period. This concept is then used not only to calculate profit, but also to rank agricultural or land use options. Messerschmidt (1989) noted that modern foresters use social science concepts and methods to improve their understanding about interdependence of forest, trees, and people.

The previous sections in this chapter showed that farmers' decision-making is influenced by multiple factors and not only based on economic measures. Therefore learning from this sub-section, in order to understand farmers' decision making, comparing costs and benefits and other quantitative variables is not enough. Ordinary farmers do not use a complex economic tool to assist them to make land-use decisions. Therefore, adopting an economic perspective or method is inadequate to address the main objective of this research, which is to understand farmers' decision-making regarding tree planting. Instead this thesis used a socio-economic perspective that includes social variables and historical factors, as the natural information studies do, to understand the actual decision-making behaviour of people. Proponents of economic perspectives usually use models to examine decision-making while proponents of the socio-economic perspective normally use attitudinal measurement or survey-based approaches. However, it has been recognised that studies in natural information also use a modelling approach, known as cognitive decision models, to understand decision-making. Therefore, this sub-section also reviews some studies on farmers' attitude to trees compared to modelling in the light of understanding land use decision-making.

In several developed countries such as England, New Zealand, Scotland, and Taiwan, studies to examine farmers' attitudes to trees were mostly based on survey analysis where lists of major reasons for tree planting were presented to farmers and they indicated which ones were relevant to them. Shelter, amenity, wood for farm uses, and social factors were rated high as benefits to include trees in their farming system. They did not place the tree's commercial value as their priority to plant trees (Murray, 1986; Scambler, 1989; Sidwell, 1989; Jen and Lin, 1997; Lise, 2000). Likewise, Rugalema et al. (1994) used a questionnaire survey to identify major constraints of farmers' response with regard to government efforts to increase farm productivity in Bukoba district, Tanzania. The study developed a cause-and-effect model of reduced productivity in home gardens of Bukoba district that was extremely useful to identify the cause of the drop in home gardens productivity especially the most important cause, lack of animal manure, not lack of nitrogen fixing trees as assumed by the government. Filius (1997) also used a similar model to examine the increase of tree cover in Gunung Kidul district, Indonesia. However, the models emphasised factors identified as important by the researchers and overlooked the reasons of farmers themselves as to why they changed their land management strategy. Again, these examples of survey research are typically the same. They focus only on the main factors that motivate land use decision-making.

A study conducted by USAID (1986) compared tree-farming programmes in six developing countries (the Philippines, Indonesia, Bangladesh, Thailand, Haiti, and the Gujarat, Kashmir, and Maharashtra regions of India). The study used a survey and interviewed tree farmers, middlemen, and government/donor agency officials to understand tree-farming practices, and income generation in each area. Findings include the following: (1) tree-planting decisions are based mainly on the cash value of the crop, even by farmers who consume much more of their crop than they sell; (2) tree-farming projects seldom include market development components that impeded further project achievement. This study in general successfully identified the main reasons and constraints of tree planting in the observed countries. However, this study did not directly look at farmers' decision-making that may be influenced by combinations of reasons and constraints that are specific only to particular countries.

Potter and Lee (1998) examined tree-planting trends in Indonesia to seek reasons for its ascendancy. They interviewed informants and key persons who included smallholders, company executives, and government officials in the West Kalimantan and Jambi provinces of Indonesia. The rapid rural appraisal (RRA) method enabled them to identify favourable factors that supported large-scale timber estate companies and smallholders' commercial forest as well as limitation factors. In line with the efforts to support smallholders' involvement, they presented findings that the smallholders' readiness to plant trees was influenced by landholding

size, absence of technical knowledge, market and policy disincentives and socio-cultural norms. Similarly, using a rapid rural appraisal (RRA), Wiersum (1999) carried out a study that focused on the household decision-making for adopting contour hedgerow intercropping in the islands of Lombok and Sumbawa, Indonesia. The objective of this study was to assess why local farmers did or did not adopt this *Leucaena* based farming practice. The results indicated that the process of adoption is heterogeneous, with medium and rich farmers tended to be more involved with the adoption than poor farmers. He argued that it seems logical as wealthier farmers generally have better access to the necessary land, labour and capital resources to apply this practice than poor farmers. This study identified reasons for adoption, such as food production and cash crop cultivation, which were different from what the project originally wanted to do, that is to protect watershed areas. Again this study did not show how the farmers made the decision. Given the limitation of the RRA method to completely learn from the farmers, the above studies forced the researchers to present their own judgement rather than the opinion of the farmers as to why they adopted tree planting. Johnson (1980); Cancian (1980); Gladwin and Murtaugh (1980) warned against the use of short periods of field observation that tends to put the researcher in the position of the enlightened, and justifies actions that are different from local people's perceptions.

Soerianegara and Mansuri (1994) conducted a questionnaire survey to examine factors contributing to the success of a tree-planting program in Gunung Kidul, central Java. They distributed questionnaires in 39 sample villages participating in the programme. A multiple linear regression analysis showed that success in the tree-planting programme was influenced by many factors. The factors were altitude, slope, effective soil depth, rockiness, productivity of the degraded land, land availability, distance to the tree-planting sites, road density, volume of fuelwood collected, and the per capita income of the villagers. This study was able to list the factors that influence farmers to plant trees but did not necessarily understand the farmers' decision-making regarding tree planting.

Understanding farmers decision-making regarding tree planting could be done through indirect approaches such as examining population growth and increased wood market. Michon and Mary (1994), supported by earlier similar studies, observed the trends and changes in village tree gardens in Cibitung district, West Java. They argued that traditional home gardens gradually lost their earlier ecological and economic features, and specialised in commercial growing of fruit trees and timber. They successfully identified the external factors that influenced the changes of villagers' strategy in managing the home gardens from time to time. Those factors entailed important changes in the dynamics of the case study itself such as high population increase and the rise of market economy. Nibbering (1999) also used an indirect

approach to learn how farmers in the Sewu Hills, Java grew trees on their holdings. Soemarwoto et al. (1985) conducted a similar study in West Java, and Nilsson (1995) also used a similar method to study farmers' motivation to integrate trees into their farms in in Cabo Delgado, Mozambique.

The above studies presented factors that identified farmers' motivation to plant trees, but they did not present any detail about how the farmers made the decision. The studies overlooked some of the subtleties of decision-making itself. Johnson (1980) and Cancian (1980) warned against putting too much faith in the indirect decision-making models that might put the researcher or policy maker in a position that is against the will of local people.

To improve the survey-based approach and other approaches to understand people's decision-making, one solution, as Gladwin and Murtaugh (1980) argued, is to allow the farmers themselves to determine the factors that influenced their decisions. Gladwin (1989) the founder of hierarchical decision tree modelling (HDM), a technique in cognitive science models, regarded farmers as experts and research should learn from them why they made a particular decision. Fujisaka, Jayson and Dapusala (1994), proponents of the HDM modelling, examined farmers' decision-making on adoption of contour hedgerows in Claveria, the Philippines. They used ethnographic interviewing to elicit from the decision-makers themselves their reasons for tree adoption. A simple farmer decision tree model was hypothesised. This 'real-life' based model was able to precisely identify the reasons for the adaptation, such as a way to address problems with soil erosion, a source of fodder for animals in dry season, and a source of green manure, and clearly depicted the specific combinations of reasons before a decision was made. On the other hand, the identified constraints against hedgerow were competition with food crops and neighbours' animals that potentially could destroy hedgerows.

Fairweather (1996) criticised the use of survey in understanding farmers' decision-making. In the survey-based approach farmers may rate a reason as important for growing trees but this may not particularly influence their decision to plant trees. Farmers would respond to a question in general terms and say what they thought would apply to farmers as a whole. That is to say, farmers may not use their stated attitudes as actual decision criteria. Their survey response may reflect what seems rational after a decision has been made. Instead, Fairweather (ibid.) conducted qualitative research to up-date understanding about why farmers planted trees in New Zealand (NZ). Following Gladwin's (1989) approach, using a theory of 'real-life' decisions (hierarchical decision tree model), he directly examined tree farmers' decision-making by interviewing a non-random sample of farmers in Hawke's Bay, NZ. His models showed particular and detailed combinations of reasons for and against tree planting. He confirmed that along with other factors, economic factors were important criteria in the

farmers' decision to plant or not to plant trees. His finding appears to be at odds with the early literature that used survey-based research, which showed that non-economic factors (shelter, aesthetic, and best land use) were regarded as important in NZ farmers' decision-making regarding tree growing.

This sub-section has reviewed the research approaches in understanding farmers and landowners' decision-making through two different approaches, attitudinal and modelling. The attitudinal approach normally use survey method to achieve its research objectives, while modelling decision-making is distinguished by the forms of economic models and non-economic models. The reviewed studies showed the advantages of non-economic models especially natural or cognitive models over survey based approaches in understanding farmers' decision-making. Non-economic models can be formulated through either qualitative or quantitative methods depending on the preference of those who conduct the studies. Therefore, remaining to be reviewed is the role of both methods in supporting decision making behaviour models.

2.3.2 Cognitive versus Statistical Behaviour model

Chibnik (1980), a proponent of quantitative methods or statistical behaviour models, argued that statistical analysis provides insight about decision-making that cannot be discovered using a natural decision-making approach (cognitive models). As an example, he presented his study on how adult male residents of two Belizean villages allocated their labour between tree cropping and wage labour. A man's village, the size of his household, the amount of money he earns from wage labour or tree crops influenced this allocation. A man's age affects the allocation more than does the size of his household. He claimed that natural decision analyses do not seem particularly useful when choice makers have difficulty describing the factors influencing their behaviour. Since decision-makers act at particular times and places, they may not know very well what they would do in different circumstances. A Belizean farmer, for example, often will say that he would grow more rice if he could market the crop easily. However, a farmer has difficulty responding when asked how much more rice he would grow if he lived in a neighbouring village where there is better access to a market.

However, Chayanov's theory in Cancian (1972); in Ortiz (1973), and in Barlett (1980) may be used to reject Chibnik's statement. Chayanov rejects the traditional economic cost-benefit calculations for the study of family farms. His evidence from massive research on Russian farmers suggests that family farms do not behave according to the calculations appropriate to capitalist firms. He challenged the validity of applying a capitalist model of production to peasant economic behaviour on the grounds that peasants do not operate a typical business, but manage a household. Peasant households, unlike capitalist firms, employ only family labour, which cannot be converted into monetary terms. A peasant household's consumption requirements correlate with family size and composition, and peasant household production will correspond to the family's development cycle. Hence, according to Chayanov's model, a peasant unit will expand its production as the family grows larger, and it will diminish its agricultural output as family size decreases as children marry and leave the household. Chayanov asserted that a farmer does not quantify precisely how much is needed, but rather uses a more qualitative estimate: "there is enough" or "there is not enough". Chayanov's theory suggests that quantitative and economic models in their assumption of economic rationality tend to omit social and cultural factors. It has been identified in this chapter that social and cultural factors are part of land-use decision-making. For this reason, it is important to use models that easily incorporate those non-economic factors.

Further Gladwin and Murtaugh (1980) criticised the use of the statistical behaviour model to examine farmer decision-making. For them there are two stages in decision making elimination of some aspects unimportant to the decision-maker (pre-attentive process), and the conscious or hard-core stage of the decision process (attentive process). They argued that statistical methods used for analysing farmers' decision-making could lead to serious error if the decision process is still in the stage of elimination by aspects. As an example they presented a study conducted by Gladwin (1980): By understanding crop-mix choice in Guatemala, Gladwin (1980) argued that people make decisions by comparing alternatives, not by ranking options. They used an additive multiple regression model to demonstrate how this model analyses the aspects that eliminate unfeasible crops in Gladwin (1980)'s research.

$$\text{Crop Y choice} = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_7X_7$$

where each X_i is one of the aspects (such as sufficient market demand). But this model assumes that a low value on one aspect can be balanced-off (traded-off against) higher values on other aspects. This model would be completely wrong, since a low value on any aspect X_i will eliminate crop Y without consideration of any other aspects. Gladwin and Murtaugh (1980) then suggested the correct model as follows:

$$\text{Crop Y choice (1:accept,0:reject)} = X_1 * X_2 * X_3 * X_4 * X_5 * X_6 * X_7$$

here each X_i has the value zero if the crop is unacceptable on that aspect and otherwise has the value of one. He showed through a simulation programme that erroneous multiple regression models such as the additive example described can appear to be highly significant predictors of decision outcome data even though they do not resemble at all the decision process that generated the data. Thus they concluded that statistical significance is no protection against assuming an erroneous model of how people make decisions. Consequently the policy results could be disastrous since an additive trade-off model, such as the illustration, implies that a recommendation having one undesirable aspect may be accepted if it is balanced by its other better aspects. Decision-making on the other hand, implies rejection of a recommendation if it fails any aspect. However, the additive multiple regression model could be useful to formalise decision-makers' calculations when they consciously manipulate the information. Johnson (1980) suggested that understanding decision-making can be made more careful by being formalised wherever possible in models of proven effectiveness, but it is never fully comprehended by them. Further, Johnson argued that people are not machine-like and that statistical behaviour models have trouble predicting their behaviour. Farmers' decision-making is full of surprising behaviour. Statistical behaviour models are less flexible in anticipating the creativity of people's decision-making lead to frustration when confronted with the behaviour of particular farmers.

Further Ortiz (1980) argued that peasant farmers cannot determine the probability of events according to chance of the incidence occurring. Hence probability decision models will not perform adequately when used to predict decisions made by such farmers. Their failure should not be rationalised with clauses about preferences for particular probability distributions. Instead, the failure should be taken as a warning of their limited applicability. Cognitive models are a distinct form of decision analysis in contrast to linear additive and probability models, which are less context-sensitive. Because the researcher uses ethnographic eliciting techniques (using the insider's point of view, not the researcher's or outsider's opinion) to specify decision criteria, s/he avoids making unrealistic assumptions about how people make an important decision. Because cognitive models use more realistic assumptions than do linear additive decisions models, they are capable of being tested. Because they are capable of being tested against choice data from many individuals to see if they predict or not, they differ from interpretative descriptions as the statistical behaviour models do. Therefore, the proponents of the cognitive models argued that these models are suited to elicitation of information about decision-making (Harris, 1979; Spradley, 1979; Gladwin, 1989; David, 1995).

Neither cognitive nor statistical behaviour models alone constitute a complete description of choice. The goals of the two analytic methods can be complementary rather than antithetical (Cancian, 1980; Mukhopadhyay, 1984). Cognitive decision analyses are attempts to describe the procedures people use in making decisions, whereas the strength of statistical behaviour analyses over cognitive decision analyses is its attempts to describe carefully the intercultural variations of those who made decisions. A combination of these analytic methods provides the possibility of understanding decision-making in a particular place, given the opportunities that exist for decision-making (Barlett, 1980).

Qualitative and quantitative approaches in social science are not commonly used together. Both have their own proponents and practitioners. The split between the quantitative and qualitative approach in social science has become a growing concern. The editor of the focus debate in *The Professional Geographer* voiced his regret over the apparently deep separation between quantitative and qualitative methods, writing that he believed the divide to be "a form of intellectual hardening that closes minds, restricts insight, and undermines our collective understanding" (Hodge, 1995).

The distinction between quantitative and qualitative methodology has been elaborated not only in sociology, but also in related fields such as evaluation research and organisational analysis. Various suggestions have been made as to how one could try to overcome this gap. One that is suggested by methods texts (Smith, 1981; Abrahamson, 1983; Chadwick et.al., 1984) is to use multiple methods in a research project. While this suggestion undoubtedly has its merits, the fact remains that few researchers incorporate more than one data collection method in their research design (Looker et al. 1989; Davies and Richards, 1999).

Obvious cost constraints argue for limiting oneself to one method. There is also the reality that many recognise but few acknowledge: many researchers in social science have been trained primarily in one method of research. Given their training, they will feel most comfortable doing one type of research. Those who do surveys tend to use a quantitative analysis perspective, based on standardised, coded information; those who do field research tend to do more qualitative analyses, with a heavy reliance on detailed verbatim quotes (Looker et al., 1989). These differences in training and preference create numerous barriers to the use of multiple methods in social science. Lincoln and Guba (1985) as well as Schwandt (1989) perceived that qualitative and quantitative approaches are incompatible. However, qualitative and quantitative analyses can be combined in one study (Sieber, 1973; Looker et al., 1989; Patton 1990; Carvalho and White, 1997). One approach is to combine field research or intensive interviews with survey style data collection.

Sieber (1973), Carvallo and White (1997), and Jefferson (1998) demonstrated in their research that this approach can be done either by supplementing the field data with some statistical analysis or by supplementing a survey with a set of intensive interviews to "flesh out" the quantitative analyses. They also point out that qualitative analyses can be useful in interpreting and refining the results from statistical analysis. Johnson (1978) reviewed a number of cases where economic anthropologists have compared quantitative predictions with empirical data. He found that the qualitative approach is still needed to explain why the majority of empirical data fail to conform to predictions of the formal models used in this comparison. On the other hand, Bryman (1984) regarded qualitative research as preparation. Its fundamental point is that because of the unstructured nature of most qualitative research with its associated lack of specified hypotheses, qualitative research is inherently exploratory. As a result of this emphasis, the qualitative researcher launches a voyage of discovery rather than one of testing. So he claims that the research is likely to stimulate new leads and routes of research that the quantitative researcher is unlikely to hit upon, but which may be used as a basis for further research. Quantitative research will follow up the leads suggested by qualitative research and will seek to confirm or reject them using the more rigorous framework associated with a natural science approach.

Bryman (1984) argued that both quantitative and qualitative approaches are best thought of as complementary and should therefore both be used in research. He emphasised that this approach has coincided with the growing attention focused upon "triangulation". Similarly, Canan and Pring (1988) believed that combining quantitative and qualitative methods allow researchers to interpret complex phenomena and to build on the strong features of both approaches. They are complementary and enrich the capability of each methodology. Carvallo and White (1997) suggested that there are limits to a purely quantitative approach as well as a purely qualitative approach. Each approach has an appropriate time and place, but in most cases both approaches will generally be required to address different aspects of a problem and to answer questions that the other approach cannot answer.

Taking advantage of modelling to examine and to develop understanding of how people make a decision, this thesis used Gladwin's (1989) hierarchical decision-tree model (HDM) as one among other cognitive science models such as taxonomies, componential analysis, scripts, etc (Werner and Schoepfle, 1987). The formulation of this HDM model uses the qualitative method. This thesis then combined the decision-tree model with the quantitative method in order to deepen understanding of the landowners' decision-making regarding tree planting as the objective of this research.

The HDM (Gladwin, 1989) examines real world decision such as Third-World farmers' decision whether to plant potatoes (the cash crop) or maize (the subsistence crop). It has application to any area of human activity where a decision is made and while it is based on individual ethnographic interviews the decisions of a group of people are examined, and illustrated by way of developing a decision tree model. In formulating this model, the researcher regards the subjects as experts, and seeks to learn from them and to discover cultural meaning.

2.4 Conclusion

The literature shows that farmers' attitudes to trees are diverse and differ from country to country and from region to region within a country. Identifying farmers' attitudes to trees that include reasons for and constraints against tree planting is important to understand their decision making. Understanding tree planters' needs is useful to governments or rural development agencies to enable them to have more farmers participate in their tree-planting programme.

Reasons for tree planting vary depending upon the needs of those who plant them. The weight of world experience, including Indonesia's tree planting programme, is that the wood market, economic return, and government incentives are apparently the strongest motivation for landowners or farmers to incorporate trees in their farming system. However, several recent studies with better approaches to examining farmers' decision-making showed that social factors and non-economic reasons are also important in influencing farmers' decision to plant trees.

Examining farmers' attitudes to trees through identifying reasons for and constraints to tree growing is important to understand the needs of tree planters. However, it is argued here that only identifying farmers' attitude to trees without examining farmers' decision-making is insufficient to understand why some people plant trees, and why some of them do not, although both perspectives are important in supporting efforts to understanding tree planters' needs. Understanding farmers' decision to plant trees needs context-sensitive understanding and details about the decision-making itself which is culturally tuned to a specific group of individuals. The literature shows that research on farmers' decision-making regarding tree planting, especially the Indonesian studies, are still focused on and dominated by identifying factors that determine farmers' decision-making, instead of directly examining the decision-making itself.

Since decision-making regarding tree planting involves non-economic variables, a socio-economic perspective provides a better approach compared to economic-based models or statistical behaviour models, which are not sufficiently robust to address the main objective of this research. Various ways with a socio-economic perspective can be used to examine farmers' decision-making, including attitudinal and modelling approaches. This chapter has identified the advantages of the modelling technique over attitudinal measurement that usually uses a survey-based approach in examining farmers' decision-making. Since modelling can be distinguished by two different methods, qualitative and quantitative, this literature review also discussed the advantages of qualitative methods and cognitive models over models that use economic measures and other quantitative variables in understanding decision-making behaviour. Accordingly, in this case the hierarchical decision-tree model or cognitive model is the appropriate way to understand farmers' decision-making regarding tree planting.

However, it is argued here that the cognitive model can be usefully supplemented by using quantitative methods. Therefore, as will be described in the next chapter, this thesis also made use of survey and statistical techniques to complement the cognitive model used in this research.

CHAPTER 3: METHODS

3.1 Introduction

The main objective of this research is to develop an understanding of farmers' decision-making regarding tree planting. To achieve this objective, a hierarchical decision tree model (HDM), cognitive modelling based on a case study is a suitable model to achieve such research objectives. The literature review showed that this model is suited to elicitation of information in the light of decision-making made by small-scale farmers, commonly found in the case study area. This chapter presents how this research made use of this method to address the research objectives.

Because the hierarchical decision tree model (HDM) uses realistic assumptions about cognitive abilities, it can be tested. The testing involves seeing whether the model predicts what the decision-maker actually does. Therefore, the research process involved developing the model and later testing it. The model was built based on unstructured interview with 146 respondents, including landowners or farmers who planted trees, and those who did not plant trees. After the decision model was formulated, a random survey sampling method was applied to test the success rate of the model as well as to gather more quantitative data about the subjects. The model testing involved 309 respondents. Hence this research makes use of a combination of both qualitative and quantitative approaches with the expectation that a better understanding of the issues will emerge from the research results. A better understanding means issues and problems are more accurately identified.

As building the decision tree model and then testing the model are the main components of the methods used by this research, accordingly this chapter comprises two parts. The first part describes how this research used a qualitative approach to gather data to formulate the hierarchical decision tree model (HDM). The second part describes how this research used a survey-based approach to test the model. The description includes how this research designed the survey instruments such as the sampling strategy and design, questionnaire construction, and how this survey was implemented. The general point of this chapter is to show the complete sequence of exercising the decision tree model to meet the research objectives. Figure 3 below shows the process by which this research was conducted.

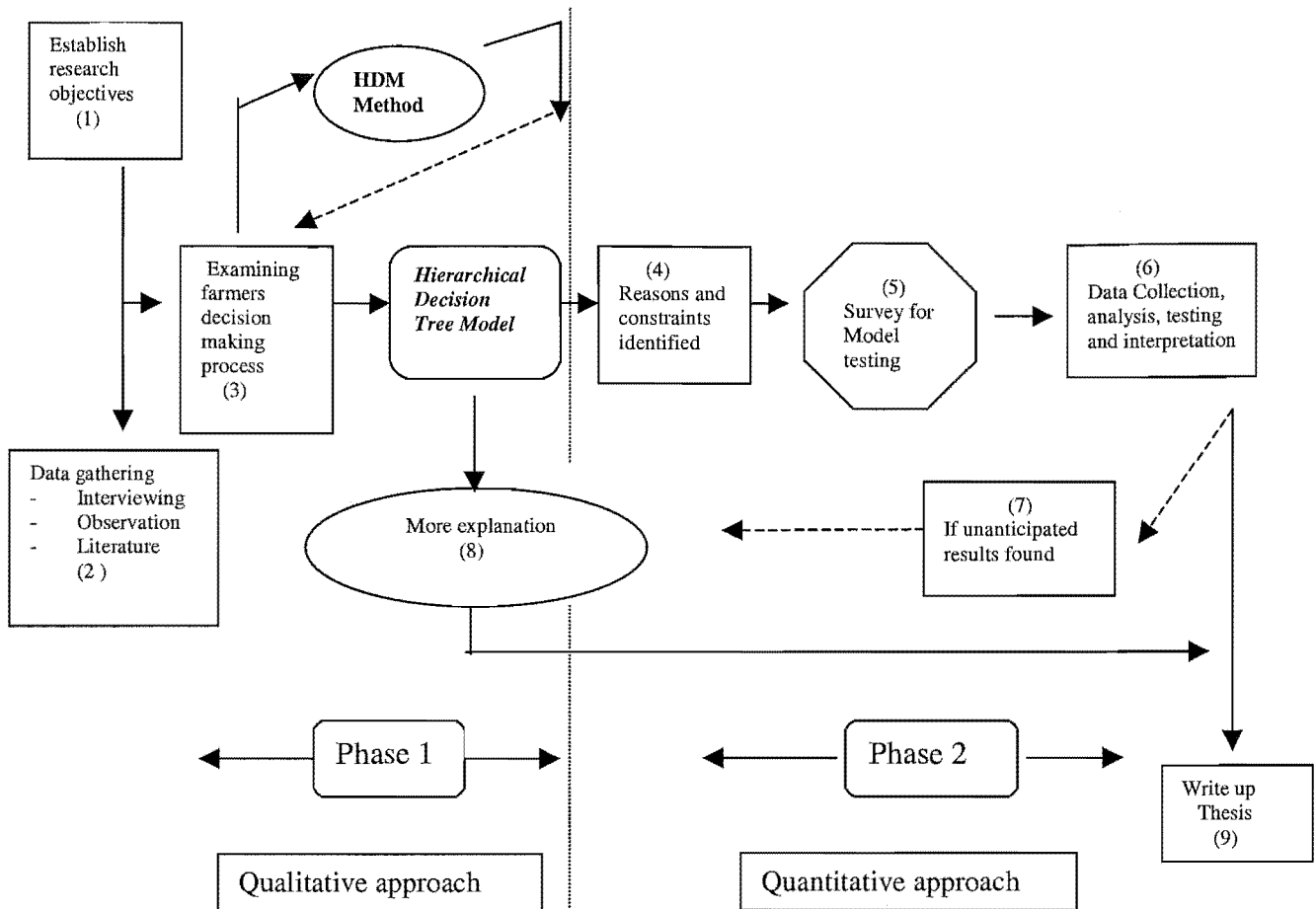


Figure 3: Research process

3.2 Hierarchical Decision-Tree Modelling

Applied anthropology is a powerful tool for research and development worldwide including forestry science. Its adaptability to the whole systems, and its suitability to case studies that highlight both the individual and the community give research sensitivity to local issues (Messerschmidt, 1992). The hierarchical decision tree modelling, an approach in anthropology can be used to depict the decision process farmers use when considering alternative actions, and to identify important issues for the developing and understanding of selected farmers' decisions (Franzel, 1983; Gladwin, 1989; Fairweather 1995). As depicted in Figure 3, in phase 1 the research began with building the hierarchical decision tree model (HDM) of Kampar farmers or landowners who decided to plant or not to plant trees for timber production.

The model was built in the following manner. First, sample/respondents who made a particular decision and who did not were identified. Second, the data was gathered through in-depth interviewing of the respondents and decision criteria elicited from the subjects themselves. Third, data were analysed. Once a set of criteria was identified, it was arranged in a tree-like

flow chart in a logical manner. The model itself contains decision criteria in the form of two alternatives or it contains constraints that must be met before an outcome is achieved. Criteria and constraints have discrete yes/no outcomes that are mutually exclusive. For any one final outcome, such as planting trees, there can be different pathways reflecting different decision criteria, and constraints. Decision criteria can involve 'elimination by aspect' that relates to availability of resources (e.g., do you have money to buy fertilizer?) or to a characteristic of a person (e.g., are you a religious person?).

In the case of the decision tree developed in this thesis for planting, or not planting trees, some specific points are relevant. First, the main purpose of this research was to understand farmers' decision making by identifying which factors influence farmers' decisions to incorporate trees into their farming systems. The decision tree model identified the key factors for why or why not trees were planted. The model was developed using in-depth interviews with a non-random sample of farmers. Hence, the task was to discover how the subjects made their decision, and to identify their decision criteria. Second, there were three groups of tree planters in the study area: tree planters under government projects, self-motivated tree planters, and tree planters under a partnership system. They had a number of similar and different choices when deciding to plant trees that enabled this research to formulate one hierarchical decision tree model that represents farmers' decision-making process for all groups of tree planters as well as non-tree planters.

3.2.1 Identifying and interviewing subjects

The reasons for and the constraints against tree planting were obtained by interviewing those who planted trees, and those who did not plant trees. Three types of community forests occurred in Riau province; thus the sample included tree planters in the government project area, self-motivated tree planters, and tree planters in the partnership system area. Before conducting the interviews, it was necessary to define who would be included as a respondent in the context of local circumstance. In this study, a respondent was defined as a person who owned and managed a farm or let someone else manage his/her farm. S/he made the decision concerning the allocation of resources on the farms and controlled the output from the farm. The researcher also decided that any person(s) managing a unit of land and its output independently from others also had the chance to be included as a respondent.

No similar research was previously conducted in Riau province. Assisted by the forestry extension workers, using the available information of community forests distribution in the Kampar region, the researcher determined the locations of people in the sample. The researcher selected the following districts as working areas, Bangkinang, Rambah, Kepenuhan, Kampar and Kampar Kiri to find all types of community forests in Riau province. The other reasons to select those districts were availability of reasonable accommodation for the researcher, and recommended by the Riau Regional Forestry Office as safe places for an outsider doing research, and far from areas where clashes were occurring between local people against logging or oil palm estate companies that sparked ethnic tensions.

In each of the above districts, the researcher visited the villages where community forests could be found to meet respondents. On every visit the researcher stayed in the house of the head of the village. The heads of village supplied the list of farmers who incorporated trees in their farming system and farmers who did not. With the available lists, the researcher identified a variety of respondents varying in gender, age, occupation, education, landholding size, religion, and ethnic group. Since there was no data about landowners' income, the researcher got help from three informants in every village to identify farmers who were categorised as high-income landowners or subsistence farmers. The indicators used by the informants included the house's appearances (wooden or brick house), possession of furniture and appliances (TV/stereo sets), the number of rubber trees, land holding, off-farm jobs, livestock, ability to send the children to high school, etc.

To avoid farmers' view of forestry staff influencing their responses, the role of forestry staff and extension workers was limited to helping the researcher to travel from one village to another, and to identify respondents. In every village visited, they stayed in the house of the head of the village while the researcher accompanied by a villager met the respondents for interview. The researcher had a chance to meet with the respondents in their day-to-day activities in their "natural setting". The interviews took place at their farms, the mosque, or their homes in the evening. All subjects were told of the general purpose of the research and were asked to describe their farm type and size, and what they planted. Once the general situation had been established, tree planters or tree owners were asked two key questions: why they planted trees, and what might constrain them from planting trees. The non-tree planters were asked two similar key questions: why they planted no trees, and what constrained them from planting trees. These key questions applied to all subjects. The interviews were unstructured and only a few questions were asked, to allow clarification and explanation. With the respondents' consent, every interview was tape recorded, and important factors or key points in their decision-making process were written, except for nine respondents who refused to be taped.

Occasionally a summary was made to check that the understanding being developed was accurate. Some respondents could be interviewed individually, but mostly they preferred to stay in groups when the interview was conducted. It indicated that they did not fully trust the researcher or that their neighbours were curious. Quite often without being asked, they gave an explanation of why they planted or did not plant trees. Toward the end of the interview, a list of questions was checked to ensure that some issues thought to be relevant had been covered. For example:

1. On which site of your farm did you plant the trees?
2. How important are rubber trees for your family?
3. How did you know about the advantages of trees?
4. Is your land situated in any agricultural project locations?
5. How do you feel if you did not plant trees while your neighbours do?
6. How do you feel by having land far from your control?
7. If you think trees are difficult to market why did you still plant them?
8. Why did you not grow the profitable oil palm as other people do?
9. How did you plant the trees if you do not have time to tend your land?
10. Do you have any proof that the land you planted with trees is yours?

There was no target sample size in this first period of research. The idea of this fieldwork was to collect as much variation as possible. Aside from distinguishing the respondents by wealth, the researcher included young and old farmers or landowners, some female landowners, farmers with small or big families. The researcher also interviewed respondents who were absentee landowners with various social backgrounds such as civil servant, businessman, army, teacher, etc. Information on each subject's income was also recorded. In addition to conducting unstructured interviews, the researcher also carried out field observation to supplement the interviews such as how good the growth of trees was, and who did the planting or tending of the trees. Interviews were tape-recorded, and observations were written. Within the period of March to May 1997 the researcher visited nine villages in five districts and interviewed 146 respondents. Table 9 provides a summary of the characteristics of the non-random sample of farmers/landowners. The sample comprises 72% subsistence farmers and 28% high-income farmers, and 20% of high-income farmers are absentee landowners. Most subsistence farmers were married men with low education, typically Riau/Malay and Moslem. Most of them had 3 – 5 children and were on farms of less than two hectares. High-income farmers/landowners were mostly self-initiated tree planters. Most of them were businessmen, with high school education and aged 36 – 45 years old. Most of the high-income landowners were also married men. All of the absentee landowners were high-income landowners. The high-income landowners did not always have farms of more than two hectares.

Table 9. Sample Population by Subsistence and High Income Farmers/Landowners (The first period of fieldwork).

		Subsistence farmers		High income farmers/landowners			
		N	%	N	%	Absentee	%
Community forest type	Government	17	16	5	12	5	17
	Self-initiative	19	18	17	41	12	40
	Partnership	22	21	3	7	0	0
	Non-tree planters	47	45	16	39	13	43
	Total	105	100	41	100	30	100
		(72%)		(28%)		(20%)	
Age	<25	17	16	0	0	0	0
	26-35	36	34	5	12	3	10
	36-45	22	21	21	51	9	30
	46-55	11	11	12	29	14	47
	>56	19	19	3	7	4	13
	Total	105	100	41	100	30	100
Gender	Female	3	3	2	5	1	3
	Male	102	97	39	95	29	97
	Total	105	100	41	100	30	100
Marital status	Not married	4	4	2	5	0	0
	Married	98	93	37	90	29	97
	Previously married	3	3	2	5	1	3
	Total	105	100	41	100	30	100
Occupation	Farmer	92	88	8	20	0	0
	Business	0	0	21	51	19	63
	Civil servant	2	2	4	10	2	7
	Government officials	0	0	6	15	6	20
	Army	0	0	2	5	2	7
	Other	11	11	0	0	1	3
	Total	105	100	41	100	30	100
Education	None	18	17	0	0	0	0
	Primary School	81	77	1	2	0	0
	Intermediate	6	6	3	7	1	3
	High School	0	0	23	56	15	50
	Tertiary	0	0	14	34	14	47
	Total	105	100	41	100	30	100
Ethnic group	Riau/Malay	73	70	11	27	2	7
	Minang	4	4	12	29	11	37
	Javanese	26	25	8	20	8	27
	Batak	2	2	10	24	9	30
	Total	105	100	41	99	30	100
Religion	Moslem	105	100	31	76	20	66
	Christian	0	0	9	22	9	30
	Other	0	0	1	02	1	03
	Total	105	100	41	100	30	100
Number of children	0	6	6	1	02	0	0
	1-2	27	26	14	34	12	40
	3-5	59	56	18	44	17	56
	>5	13	13	8	19	1	3
	Total	105	100	41	100	30	100
Farms size (ha)	1-2	58	55	17	41	17	56
	2-5	36	34	17	41	10	33
	>5	11	11	7	17	3	10
	Total	105	100	41	100	30	100

3.2.2 Formulating the HDM

Gladwin (1989) specified that decision trees can be developed either sequentially, that is after each interview, or examining all interviews after they are completed. The latter technique was used in this research. With all tape recording and field notes, the researcher went back to the University of Canterbury, New Zealand. Each interview was examined by reference to the detailed notes made and by elaborating these notes, where necessary, when listening to the tape recording. After each interview was examined a summary of key points was drawn up. This summary included the list of reasons and constraints regarding tree planting. The next step was the contrasting in order to be able to draw the model by comparing reasons for and constraints to tree planting.

As the decision trees were being developed the contrasts were used to identify decision criteria. The decision trees themselves evolved slowly as each interview was analysed. Early decision trees were revised to make them consistent with later interviews and notes. This process was difficult and time-consuming. It required integrating each additional interview while at the same time developing and maintaining common themes. Early interviews were repeatedly re-examined to ensure that the developing decision tree was consistent with them and the latest interview being considered. Some key points originally considered important or contrasts were discarded or modified in the light of integrating later interviews. At all times the model had to fit the data of the interview.

A hierarchical decision tree model was thus formulated, as it will be presented in the next chapter. The model represents the decision-making by different groups of landowners as to why they planted trees, and why they did not. The next step was to validate the model.

3.3 Questionnaire survey

The objective of this survey was to test the hierarchical decision tree model (HDM) that was developed in phase 1. If the HDM is an accurate model, it will predict outcomes, namely plant or not plant trees for another independent sample of landowners. As the founder of this method, Gladwin (1989) argued that a model is accurate if it predicts with 85-90% accuracy. This second phase of research included a number of the following activities, sample design and size, selecting respondents, constructing the questionnaire, the use of survey helpers and data analysis. Another objective of this survey was to collect quantitative data to strengthen the analysis of decision-making.

3.3.1 Sample size

Secondary data on the number of tree planters in Riau province was not available although the Riau Regional Forestry Office, (1997) estimated that approximately 6,000-7,000 landowners planted trees in Riau province. Therefore, the research used the standard error adjustment method of the available data to estimate the target sample size. As the targeted population was divided into four groups, government project tree planters, partnership system tree planters, self-motivated tree planters, and non-tree planters, a stratified random sampling technique was used to randomly select subjects (deVaus, 1995). This sampling design, which is the most efficient, is a good choice when differentiated information is needed regarding various strata within the population known to differ in their parameters (Sekaran, 1994). Stratification was to allow examination of the following questions:

- Are the self-motivated tree planters wealthier and younger than the other two groups of tree planters?
- Are the self-motivated planters more committed to maintaining the trees than the other two groups of tree planters?
- Are the self-motivated tree planters motivated by perceived market, and government project tree planters driven by incentives?

In the first period of fieldwork (Stage I), the researcher had 161 cases that covered respondents' age, education, ethnicity, total land owned, income, and number of dependants. The 161 cases consisted of 59 tree planters under government projects, 23 tree planters under the partnership system, 51 self-motivated tree planters, and 28 non-tree planters. These data were not collected on a random sample. However, Sekaran (1994) argued that non-probability sampling can lead to potentially useful information with regard to a population. The data showed that since the respondents' income had more variation compared to other variables, the research used income as a 'bench-mark' to work out standard deviations (s) to determine sample size. Table 10 summarises the relevant data.

Table 10: Statistical Summary of the Income (Rupiah/Year) of 161 Respondents

Types	n	Average (\bar{X})	Std Deviation (s)	Std Error ($S\bar{x}$)
Government Project	59	3,303,358	1,776,970	231,342
Partnership system	23	3,473,862	1,739,446	370,851
Self-motivated	51	10,177,428	6,361,128	899,599
Non-trees planters	28	14,145,179	8,185,034	1,575,211

The research then determined the sample size through adjusting the standard error of the 161 samples to a desirable level, in this case it was set up $\pm 10\%$ of the sample mean. Sekaran (1994) and deVaus (1995) argued that if the standard error is reduced, the sampling error is also reduced. The standard error depends on the size of the sample. With increasing sample size the standard error is decreased. Thus an acceptable standard error can be achieved by changing the sample size. This method was done firstly by setting up the desirable standard error, and then followed by determining the sample size.

Another noteworthy point is that the smaller the variation in the population, the smaller the standard error, which in turn implies that the sample size need not necessarily be large (Sekaran, 1994). Table 10 shows that tree planters under government projects and the partnership system have a similar variance. The data also show that tree planters under a partnership system should have a smaller sample size than that of the other groups because it has the smallest variance.

The mean income (\bar{X}) in Table 10 is a point estimate of μ (population mean), that enables the research to construct a confidence interval around \bar{X} to estimate the range within which μ would fall. The standard error $S\bar{x}$ and the percentage or level of confidence that the research required would determine the width of the interval, which can be represented by the following formula (Sekaran, 1992):

$$\mu = \bar{x} \pm KS\bar{x},$$

where:

μ is population mean, \bar{x} is sample mean, $S\bar{x}$ is standard error, and K is the t statistic for the level of confidence desired.

As *precision* denotes how close in estimating the population parameter based on the sample statistic, *confidence* denotes how certain it is that the estimates will really hold true for the population. So *confidence* reflects the level of certainty with which we can state that our estimates of the population parameters (population mean, population variances, and population standard deviation), and a 95 percent confidence level is accepted for most common research (Sekaran, 1994; Gravettes and Wallnau, 1995).

The calculation of the 161 sample showed that $\mu = \bar{x} \pm 21\%$ at 95 percent confidence level. Therefore, this research required its estimates to be less than 21% of the true average income of each group in the population. With this formula, $\mu = \bar{x} \pm K S\bar{x}$, it was calculated that the research needed a sample of at least 700 if the required standard errors were set less than 10%. This sample size was too large considering funding and time that the research had, so the research reduced the calculated sample size by widening the confidence limit or increasing the standard error. It must be stressed that large samples do not always guarantee a higher degree of precision or general success in a research study (Sarantakos, 1993; deVaus, 1995). Sarantakos (1993) argued that the quality of the results depends on several factors and the sample size is only one of them. The research then reduced the sample size by increasing the standard error through widening the confidence limit to 90 percent (the K value of 1.645) that was calculated as follows:

Using the formula of $\mu = \bar{x} \pm K S\bar{x}$, the research wanted the deviation for each group's income in Table 10 to be not be higher than 10% of the true average income in population, therefore:

Government projects tree planters	= $\pm 10\%$ of (3,303,358) =	330,336
Partnership system tree planters	= $\pm 10\%$ of (3,473,862) =	347,386
Self-motivated tree planters	= $\pm 10\%$ of (10,177,428) =	1,017,743
Non-tree planters	= $\pm 10\%$ of (14,145,179) =	1,414,518

The research desired standard error at 90% confidence limit ($K = 1.645$ value table) for each group's income, therefore:

Government projects tree planters	=	330,336 : 1.645 =	200,812
Partnership system tree planters	=	347,386 : 1.645 =	211,176
Self-motivated tree planters	=	1,017,743 : 1.645 =	618,688
Non-tree planters	=	1,414,518 : 1.645 =	859,889

Since the desired standard error had been set up, the sample size was calculated by the following formula (Sekaran, 1992).

$$S\bar{x} = \frac{s}{\sqrt{n-1}}$$

Where: s = the standard deviation of the sample, n = the sample size, $S\bar{x}$ = the standard error or the extent of precision offered by the sample.

Hence, using the data at Table 10, the research calculated the following sample size (n) of each group:

Government project tree planters

$$200,812 = \frac{1776970}{\sqrt{n-1}} \rightarrow (\sqrt{n-1}) 200,812 = 1,776,970 \rightarrow n = 77 \text{ respondents}$$

Partnership system tree planters

$$211,176 = \frac{1739446}{\sqrt{n-1}} \rightarrow (\sqrt{n-1}) 211,176 = 1,739,446 \rightarrow n = 66 \text{ respondents}$$

Self-motivated tree planters

$$618,688 = \frac{6361128}{\sqrt{n-1}} \rightarrow (\sqrt{n-1}) 618,688 = 6,361,128 \rightarrow n = 104 \text{ respondents}$$

Non-trees planter

$$859,889 = \frac{8185034}{\sqrt{n-1}} \rightarrow (\sqrt{n-1}) 859,889 = 8,185,034 \rightarrow n = 89 \text{ respondents}$$

Therefore, the target of respondents were 336 that consisted of the following allocation:

Government projects	→	n = 77
Partnership system	→	n = 66
Self-motivated	→	n = 104
Non-trees planters	→	n = 89

Total :	→	336 respondents
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Having determined the appropriate sample size, the remaining consideration is the process by which respondents were selected.

3.3.2 Selecting villages and respondents

A farmer/landowner was the unit of analysis, and farmers or landowners who lived in a village that had community forests were the targets. Learning from the first period of fieldwork experience, due to accessibility, distance and the time spent in each village, it was calculated that a week of survey work would only cover a maximum of three villages. Therefore, for approximately two months fieldwork, the survey would be able to cover a maximum of 24 villages.

Kampar region has 19 districts that consist of 238 villages. However, among them only 103 villages have community forests. Government projects were located in 53 villages, self-motivated type could be found in 49 villages, and partnership system groups were established

in only 6 villages. Some villages have more than one type of community forest and some of them have only a single type of community forest. Non-tree planters could be found in every village. Therefore, every village where community forestry could be found had a chance to be selected as a location of the respondents. However, there were some villages where both government project and self-motivated were found adjacent to each other. Usually in such villages, these two community forest types had the same landowners because they used the leftover or surplus projects' seedlings to plant their idle lands adjacent to government projects' locations. These landowners had the expectation that if the government expanded the tree-planting projects, it would include their lands and it meant they would receive more incentives to plant more trees in their lands. It is different from what the MoF claimed that the trees planted in adjacent project areas were the results of the awareness of local people about the benefits of trees. Therefore, the survey excluded these villages from the survey sites in order to avoid bias, and included only the villages that had one type of community forest.

Based on the data from the Office of Conservation and Land Rehabilitation, Pekanbaru (1997), the total number of villages with only have a single type of community forest is as follow:

-	Government project	: 39 villages
-	Partnership system	: 4 villages
-	Self-motivated	: 29 villages

		72 villages

Considering the maximum number the survey could cover was 24 villages, thus the research proportionally determined the target number of villages to be surveyed as follows:

-	Government project:	$39/72 * 24 = 13$ villages
-	Partnership system:	$4/72 * 24 = 1$ village
-	Self- motivated:	$29/72 * 24 = 10$ villages

Since the village that has tree planters under the partnership system only appears as one village, to ensure adequate background variation of tree planters under the partnership system, the research changed the composition of the required number of villages as follows:

-	Government project	: 12 villages
-	Partnership system	: 3 villages
-	Self-motivated	: 9 villages

		24 villages

The targeted respondents were 336, so the next step was to determine the target number of cases per village for the 24 villages.

Government project tree planters:

Each village in this category needed 77 cases/12 villages = 7 cases/village

Partnership system tree planters:

Each village in this category needed 66 sample/3 villages = 22 cases/village

Self-motivated tree planters:

Each village in this category needed 104 sample/9 villages = 12 cases/village

The respondents of non-tree planters were also taken from each of the 24 selected villages. The number of cases of non-tree planters was determined proportionally against the three types of tree planters, therefore:

$$\text{In the government project villages} : \frac{77}{(336 - 89)} \times 89 = 28$$

Where: 77 are the target respondents of tree planters under government project, 336 are the total of the target respondents, and 89 are the target respondents of non-tree planters. If 28 non-tree planters had to be found in 12 villages that had government tree planters projects, thus in one village the survey had to find two cases of non-tree planters for each village.

$$\text{In the partnership system villages} : \frac{66}{(336 - 89)} \times 89 = 24$$

Where: 66 are the target respondents of tree planters under partnership system, 336 are the total of the target total respondents, and 89 are the target respondents of non-tree planters. If 24 respondents of non-tree planters had to be found in three villages of tree planters under the partnership system, so in each village the survey had to find eight non-tree planters respondents.

$$\text{In the self-motivated villages} : \frac{104}{(336 - 89)} \times 89 = 37$$

Where: 104 are the target respondents of self-motivated tree planters, 336 are the total of the target respondents, and 89 are the target respondents of non-tree planters. If 37 sample of non-tree planters had to be found in nine villages, so in one village the survey had to find four non-tree planter respondents. The Table 11 below summarises the number of respondents required by the survey.

Table 11: Minimum Sample Required in Each Surveyed Village

Types	Sample required	Villages required	Respondents	
			Trees	Non-trees
Government project	77	12	7	2
Partnership system	66	3	22	8
Self-motivated	104	9	12	4
Non-tree planters	89			
Total	336	24	247	89

3.3.3 Questionnaire, design and administration

This sub-section presents survey preparation and administration. The preparation stage included writing the questionnaire, gathering secondary data, recruiting and organising survey helpers, piloting and revising questionnaires. The implementation stage included fieldwork with the survey helpers, monitoring and survey evaluation. Obtaining a survey permit was also part of the survey preparation. The main task of this questionnaire survey was to examine the adequacy of the model so the questions in the questionnaire were purely an extension of the decision criteria in the formulated HDM. Except for questions that were asking for background information or personal data of the respondents, there was no question unrelated to the decision criteria in the HDM. The early version of the questionnaire was made at the School of Forestry, University of Canterbury, New Zealand. The questions were made as easy as possible to understand, and the answers were dominated by Yes and No responses. It was expected that the such a questionnaire would get a high response rate considering the simple nature of the questionnaire. Later during questionnaire testing in the study area, the questionnaire underwent several changes of wording to fit the respondents' understanding.

The questionnaires were of two types for tree planters, and for non-tree planters. The questionnaire for tree planters consisted of two parts. Part A was designed to test the accuracy of the model that was made of Yes and No answers (see Appendix: the questions were written in italic font). Part B was designed to check the consistency of the answers given for Part A. Questions in Part B were just a modification of those in Part A, where the respondent was

presented with a choice of important or not important for a particular factor that influenced his/her land use decision-making. The questionnaire for tree planters had 63 questions in total, while the questionnaire for non-tree planters had 41 questions.

Learning from the first fieldwork, the villagers, especially those who were involved in the community forestry programme, were generally reluctant to give an explanation especially to outsiders. They were waiting for the project incentives and wood market that the government and company partners had promised. Some government and project officers or company staff came to the villages and promised that they would sort out the problems, but still the promises had not been realised. This situation caused the tree planters to be frustrated and they did not trust outsiders. Further, as will be shown in the result chapter, many farmers planted trees on state land to occupy the land. Therefore, community forestry in Riau was not simply tree planting activities but was concerned with the control of land so the farmers might suspect that the outsider would inform the authority about their illegal practice. In addition, ethnic tensions and clashes had taken place in some villages due to land disputes. The researcher learnt that many villagers were reluctant to give written statements to outsiders since they suspected the outsiders would misuse their statements. By employing local people to help the survey, the researcher expected that the respondents would be more cooperative. The preferences were that survey helpers must not be from forestry extension, or anyone that might cause unnecessary survey bias. The main tasks of the survey helpers were to assist the researcher to test the questionnaire and to administer the questionnaire. In this second phase of fieldwork, the survey helpers made contact and dealt with the respondents.

Information regarding the availability of survey helpers was obtained from the University of Riau, and rural development projects that were experienced with social surveys in Riau province. Contact was made through these institutions and the researcher met the recommended survey helpers in Pekanbaru. A contract had been agreed, and the nucleus team was set up. The nucleus team consisted of the researcher and four experienced survey helpers. The tasks of the nucleus team were to pilot the questionnaire, to select districts and the villages to be surveyed, to make contact, organise and train more helpers, and to monitor and evaluate the survey implementation. Later, with more survey helpers, the nucleus team and the additional survey helpers then were called the survey team.

The first task of the nucleus team was to assist the researcher to refine the questionnaire that was prepared in New Zealand by piloting this questionnaire. The aim was to provide an understandable questionnaire with the expectation of producing a high response rate. For this purpose, the nucleus team (including the researcher) visited the closest two districts from Pekanbaru, Bangkinang district, and Kampar district, and five villages within these districts had

all types of tree planters, government projects, self-motivated, and under partnership system. With the help of the heads of villages and the heads of farmer groups, the nucleus team was able to meet a group of farmers and landowners in the meetinghouse in every visited village. They were invited to gather in the heads of village's houses. More than 40 people attended the gathering in every visited village. These people included tree farmers, rubber farmers, oil palm farmers, citrus farmers, tree owners, and oil palm owners. They also had diverse backgrounds in age, in education, and in occupation, but they were all males. These farmers were divided into two groups, tree planters, and non-tree planters, and were asked to fill out the questionnaire. Those who were literate filled in the questionnaire by themselves, and the time was recorded. Those who had difficulty in reading were helped by the team survey to understand the questionnaire. Some farmers did not want to participate in this activity and just watched. Every time they finished with the questionnaire, they were asked their general impression and opinion about how to make each question more understandable. The researcher made notes of their suggestions, and then refined and improved the wording of the questionnaire without altering the original meaning. This procedure was followed for all villages. The questionnaire underwent seven revisions during this piloting procedure. It was recorded that a person needed on average one and half hour to fill out the questionnaire. The villages used for piloting the questionnaire were additional to the sample.

After completing the piloting of the questionnaire, the nucleus team began with designing the survey. From the available secondary data the nucleus team worked out the lists of community forest locations. The team produced three lists, government tree planters in 53 villages, the self-motivated tree planters in 49 villages, and partnership system tree planters in 6 villages. Assisted by the forestry extension workers, the nucleus team excluded villages where community forests under government project and self-motivated were situated adjacent to each other as they usually had the same owners. The nucleus team also removed five villages used for piloting the questionnaire, and two villages where tree planting in 1998 occurred because the HDM was constructed based on the data up to 1997. The nucleus team numbered all villages in each list. The final lists had 84 villages that contained 47 villages of community forest under government project, 32 villages of the self-motivated community forestry, and 5 villages of partnership system. As shown in Table 11, the survey only needed 24 villages. Therefore, using random number, from the available lists, the nucleus team selected 12 government projects villages, 9 self-motivated villages, and 3 partner system villages. Table 12 shows the randomly selected 24 villages that were situated in 12 districts in Kampar region.

Table 12: List of Randomly Selected 24 Villages

No	Government project		No	Self-initiative		No	Partner system	
	Village	District		Village	District		Village	District
1	Pkl. Lesung	Pkl. Kuras	1	Koto Garo	Siak Hulu	1	Pasir Intan	Rambah
2	Suka Maju	Tambusai	2	Ram. Tengah	Rambah	2	Pasir Agung	Rambah
3	Rambah Hilir	Rambah	3	Pasir Agung	Rambah	3	Pasir Luhur	K. Darusalam
4	Pasir Jaya	Rambah	4	Sawah	Kampar			
5	Rambah Jaya	Rambah	5	Kepenuhan Jaya	Kepenuhan			
6	Kabun	Tandun	6	Pkl. Panduk	Kuala Kampar			
7	Panyasawan	Kampar	7	Tadung Jaya	Tandun			
8	Koto Panjang	Kampar	8	Dayo	Tandun			
9	Penarikan	Langgam	9	Pulau Jambu	Bangkinang			
10	Pasir Luhur	K. Darusalam						
11	Lipat Kain	Kampar Kiri						
12	Kuok	Bangkinang						

After selecting the villages to be surveyed, the nucleus team went on to obtain from the village apparatus and the head of farmers groups the list of farmers of the 24 selected villages. It took about a month to gather the lists due to poor communication and the village administration system. The nucleus team was able to gather the names and addresses of 1764 farmers, and put them on the selection list. It consisted of 812 tree planters and 952 non-tree planters. The researcher supplied the data of 146 respondents who were used to formulate the HDM in the first fieldwork as 26 tree planters and 39 non-tree planters were on the selection list, and these were excluded from the list. The survey, as shown in Table 11, needed 336 respondents. Using random numbers, the nucleus team selected 400 respondents that comprised 130 non-tree planters, 80 government tree planters, 80 partnership tree planters, and 110 self-motivated tree planters. The list of selected respondents then was grouped according to the villages where they lived.

Since the survey had to deal with a relatively large sample and covered large areas, additional survey helpers were needed particularly those who lived in the selected districts. As planned, assisted by the forestry extension workers who lived in the selected districts, the nucleus team was able to get mostly schoolteachers to become survey helpers in the selected districts. There were two additional survey helpers who were not schoolteachers, but they were in charge of youth organisations in their districts. The teachers had usually graduated from Teacher Educational School in Pekanbaru (the same level as High School). They were young persons (18-25 years old) and well respected by most villagers because of their education and their

tasks. The teachers were employed by central government, thus they were not dependent on the villages' apparatus. By employing teachers as the survey helpers, the survey was able to give a non-political impression in an effort to reduce bias. Because of these advantages, some previous rural studies in Riau had made use of schoolteachers as contact persons, extensionists, guides, or interpreters (Tim Nolan, ODA Project Manager, personal communication, 1997). The teachers were also able to reach female landowners who are culturally reluctant to talk to strangers. With the additional helpers the total number of people who worked for the survey team became 12. This recruitment was crucial since the data collection depended on how the survey helpers performed their task. All the survey helpers underwent training before they started the job. The training was conducted in Pekanbaru, supervised by the nucleus team and was made to make sure that all the survey helpers understood the questionnaire, knew how to administer the questionnaire, and knew how to encourage the respondents to participate in the survey. Every survey helper had to meet the respondent individually. The survey helpers had to convince the respondents that the purpose of the survey was purely university research and nothing to do with the government or political parties' activities, and that the filled-out questionnaire remained anonymous. The respondents were allowed to discuss the answers with family members and if necessary, the survey helpers read the questionnaire for them without directing the answers. The helper had to put the filled-out questionnaire in a sealed envelope. In case the selected respondents refused to participate or were out of the village, using the available list of landowners, the survey helpers were advised to record how many of them were unable to be contacted.

After the survey helpers understood what they should do, directed by the nucleus team they followed up the list of respondents. Each survey helper had his/her own assignment determined by their familiarity with the districts to be surveyed. With the list of respondents on hand, the survey helpers were dispatched to visit the respondents. The researcher's task was to monitor the survey implementation by meeting them in agreed districts where the survey team could have meetings to evaluate the progress.

The following paragraph summarises the evaluation of the work done by the survey helpers. Owing to low accessibility, as predicted a survey helper was only able to interview a maximum of three respondents a day. Filling out the questionnaire took 1-2 hours per respondent. In most cases the survey helpers read and explained every question for them, not because the respondents were mostly illiterate, but because they just wanted to be sure that the questionnaire would not put them into trouble. There were 44 respondents who refused to participate in the survey, 14 respondents were out of their village when the survey helpers visited them, and 13 could not be found.

The survey team noted that 11 filled questionnaires got lost, and noticed in the field that some survey helpers replaced the selected respondents with other landowners in the same village because they were difficult to meet or refused to participate. This happened nine times. Munn and Drever (1995) said that statistically they should be omitted, especially if there are only a few of them in a large sample. There was no way to replace them with new potential respondents. Therefore, the researcher removed the nine additional respondents. Another problem was that the assigned survey helpers refused to work in two villages in Tandun district where fighting had erupted between local people against a forest company employees that later sparked ethnic conflict. All respondents who could not be found were government and self-motivated tree planters, and of the respondents who were not home when the survey was conducted, 57 percent of them were self-motivated tree planters. Those who refused to participate were 23 percent of sample, and 50 percent of them were non-tree planters. The absentee respondents were relatively easy to handle since they mostly requested that the questionnaire to be left with them and the survey team collected it later. During the period of August to October 1999, the researcher was able to get back 309 completed questionnaires or 92 percent of the targeted responses. Data were collected from 12 districts that consisted of 22 villages. Table 13 summarises the survey evaluation, and Table 14 presents a summary of background character of the sample.

Table 13: Summary of Survey Evaluation

Description	Tree planters			Non-tree planters	Total
	Government	Self-motivated	Partnership		
Total questionnaires	80	110	80	130	400
Targeted questionnaires	77	104	66	89	336
Returned questionnaires	62	83	58	106	309
Unreturned questionnaires					91
- Respondents refuse to participate	5	15	2	22	44
- Respondents were out of district	4	8	-	2	14
- Respondents could not be found	6	7	-	-	13
- Questionnaire lost	-	-	-	-	11
- Questionnaire dropped	-	3	-	6	9
Villages unable to be visited					2

Table 14. Background Characteristic of Sample Population in the Questionnaire Survey

	Government	%	Self-motivated	%	Partnership	%	Non-tree planters	%
Respondents	62	20.7	83	26.8	58	18.7	106	34.3
Age								
≤25	2	3	1	1	7	12	8	8
26-35	15	24	25	30	19	33	38	36
36-45	22	35	43	60	19	33	42	40
46-55	14	23	13	16	10	17	15	14
56≥	9	15	1	1	3	5	3	3
Total	62		83		58		106	100
Gender								
Female	8	13	6	7	11	19	15	14
Male	54	87	77	93	48	83	91	86
Total	62		83		58		106	100
Marital status								
Not married	6	10	0	0	3	5	4	4
Married	48	77	77	93	48	83	87	82
Previously married	8	13	6	7	7	12	15	14
Total	62		83		58		106	100
Occupation								
Farmer	29	47	23	28	49	84	42	40
Business	11	18	37	45	5	9	41	39
Civil servant	11	18	16	19	2	3	24	13
Govt officials	7	11	3	4	1	2	6	6
Other	4	6	4	5	1	2	3	3
Total	62		83		58		106	100
Education								
None	2	3	1	1	0	0	6	6
Primary	27	44	31	37	33	57	55	52
Intermediate	18	29	17	20	21	36	17	16
High School	12	19	30	36	4	7	20	19
Tertiary	3	5	4	5	0	0	8	8
Total	62		83		58		106	100
Ethnic group								
Riau/Malay	49	79	34	41	13	22	32	30
Padang	3	5	18	22	4	7	11	10
Javanese	8	13	22	27	41	71	26	25
Batak	2	3	9	11	0	0	37	35
Total	62		83		58		106	100
Religion								
Moslem	60	97	80	96	57	98	77	73
Christian	1	2	3	4	1	2	24	23
Others	1	2	0	0	0	0	5	5
Total	62		83		58		106	100
Number of children								
0	8	13	8	10	5	9	6	6
1 – 2	17	27	28	34	15	26	42	40
3 – 5	27	44	35	42	22	38	39	37
>5	10	16	12	14	16	28	19	18
Total	62		83		58		106	100
Farm size								
1-2	14	23	39	47	4	7	40	38
2-5	33	53	33	40	41	71	51	48
>5	15	24	11	13	13	22	15	14
Total	62		83		58		106	100

Table 14 shows that most of the sample were married male farmers, although the non-tree planters group indicates a high percentage of landowners who worked as businessmen. The table shows that most of the landowners were 36 – 45 years old, typically Riau/Malay and Moslems with low educational background except self-motivated tree planters. Most of the landowners had a total farm size of 2 – 5 hectares.

During the evaluation, the researcher had a chance to examine in detail some of the returned questionnaires. The researcher identified when the model failed to predict a respondent's choice or a decision process. The model made an error if it predicted the respondent took a certain decision path but s/he did not. The returned questionnaire that contained error answers were separated and analysed to find out what the errors had in common. While in the field, outside of the survey implementation, the researcher interviewed another eight self-motivated tree planters, 11 partnership-system tree planters, and seven non-tree planters. The purpose of these additional interviews was to find out the causes why the model made some errors, which was important when this research later modified the model to address the errors. The complete analysis of all the returned questionnaires was done at the University of Canterbury, New Zealand. Errors were counted according to each decision path in the HDM to calculate the success rate of the model. The "success rate " for the model then was then calculated by dividing the total number of successes by the total number of cases, and the result of this model validation is presented in Chapter 4.

3.4 Data analysis

The data produced by the questionnaires were analysed both to test the HDM, and to perform statistical analysis. To test the HDM, the researcher examined each individual completed questionnaire. To perform statistical analysis, the data were organised in the form of frequency distribution tables to show how the frequency of individual answers was distributed across the decision-criteria or choices as identified by the HDM. The idea of this analysis was to use a descriptive statistic technique that allows the research to examine any trends in the quantitative data that can be associated with the HDM.

For each sample group, the data were arranged in a table that consisted of three columns. The first column presented a list of decision criteria or choices, the second and third columns indicated frequency (f) and percentage (%). This data structure produced bar graphs (as presented in the results chapter) to show distribution of choice types within the sample. Statistical tests were then applied to show whether or not different groups have different decision-making.

3.5 Conclusion

To achieve the research objectives, this research made use of combination approaches, qualitative and quantitative approaches. The qualitative approach was represented by the application of hierarchical decision tree model (HDM), and the quantitative approach was represented by the use of the questionnaire survey. Both methods were conducted in the study area, but at different times.

The HDM method was used to develop a decision-making model of landowners who decided to plant or not to plant trees for timber, whereas the survey random sampling was conducted to test the accuracy of the model to predict farmers and landowners decision behaviour as well as to gather quantitative data. The research used 146 cases to develop the decision-making model, and 309 respondents to test the model. The process of developing the model involved face-to-face in-depth interviewing that was conducted by the researcher in the first period of fieldwork, and the questionnaire survey was conducted with the help of survey helpers in the second period of fieldwork.

Together with a few other studies that use a qualitative approach, the use of HDM in this research has enriched the methods used in examining and understanding farmers decision-making regarding tree planting which are typically approached by attitudinal measures. Further, the application of model testing has advanced earlier studies that used the decision tree model to examine farmers' decision-making. The use of a quantitative approach as a supplement to the formulation of the HDM is also a relatively new approach in the application of this method.

CHAPTER 4: RESULTS

4.1 Introduction

Corresponding to the use of qualitative and quantitative approaches as described in the methods chapter, this chapter consists of three main parts. The first part presents the formulated hierarchical decision tree model (HDM) of landowners who planted and did not plant trees for timber production in the Kampar region, Riau province, and highlights their reasons and constraints regarding tree planting. The second part presents the results of testing of HDM to cater for the need to evaluate the accuracy of the model. During the testing process, the research gathered quantitative data; therefore the third part of this chapter presents the results of statistical analysis of the data, which were then combined with the HDM to develop a detailed understanding of why landowners in the study area planted or did not plant trees.

4.2 The HDM of Kampar Landowners Regarding Tree Planting

The research formulated a Hierarchical Decision Tree Model (HDM) that depicts decision processes of landowners in the Kampar region as to why they decided to plant trees for timber production and why they did not (Figure 4). Rather than producing several separate models, this model represents a combination of decision models made by landowners who planted trees under government project, were assisted by forestry companies, who planted trees independently, and the those who did not grow trees. The decision pathways made by those who planted trees under government or company assistance are located in the left side of the HDM (criteria 4,5,6,7,8) while the decision pathways made by self-motivated tree planters are located in the right side of the HDM (criteria 9 to 18).

4.2.1 Decision criteria in the HDM

This section presents a general description of the decision criteria identified by the first, non-random, sample of landowners in the process of deciding whether or not to plant trees. In making such a decision, the sample did not rely on single decision criterion but rather took a sequence of decision criteria. A more comprehensive explanation about decision criteria in the HDM will be presented in Section 4.4 that shows a combination of results from qualitative and quantitative approaches.

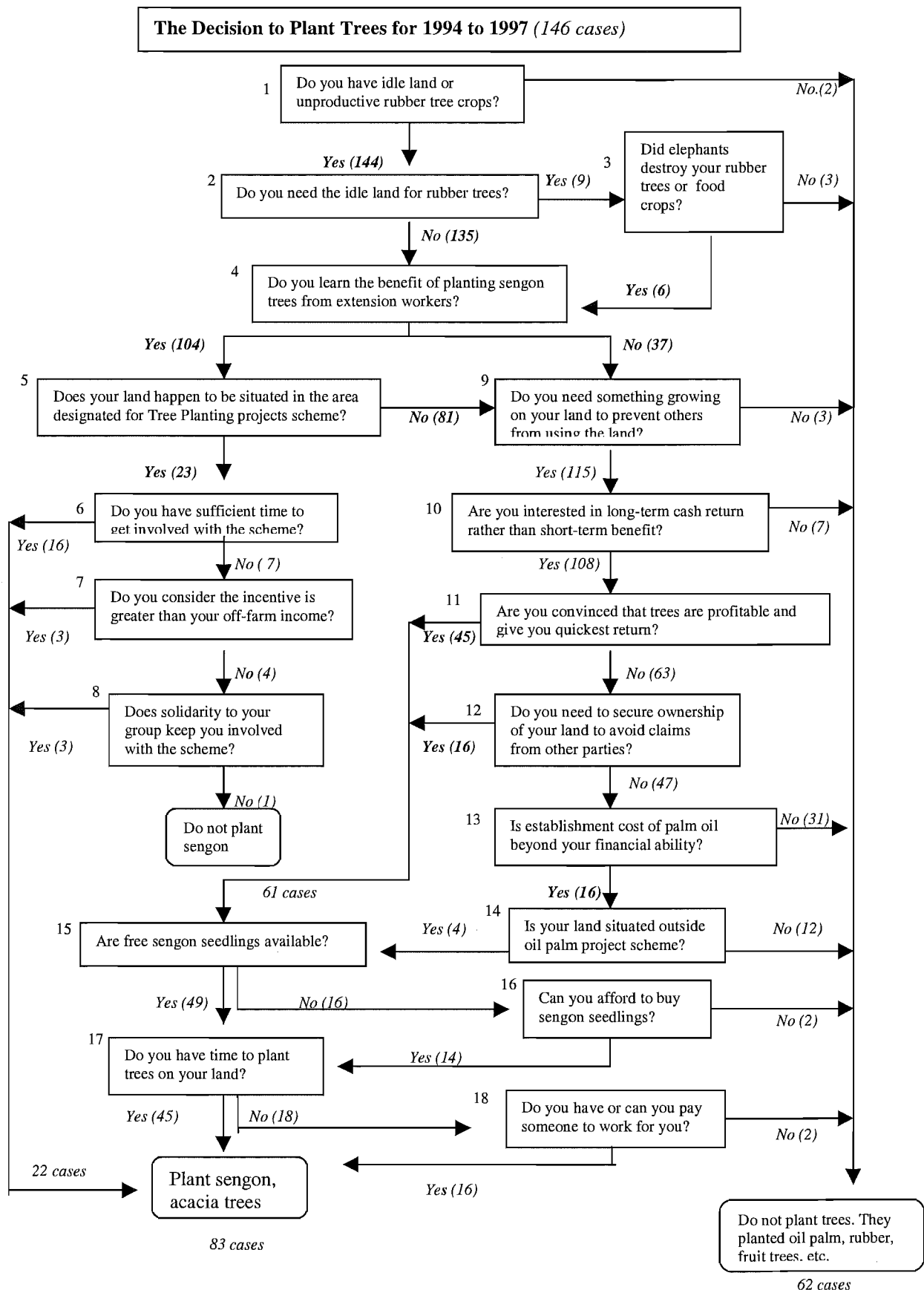


Figure 4: The decision tree model of plant or do not plant trees, Kampar, Riau 1997.

Decision Criterion 1 - *Do you have idle land or unproductive rubber plantations?*

Without land people would not plant any tree. If landowners have idle land or unproductive rubber tree plantation, they might decide to use the land to grow trees. The idle land is part of their farm which is not cultivated due to lack of resources such as finance, time and labour to manage all the land.

Decision Criterion 2 - *Do you need the idle land for rubber?*

Rubber tapping is the main source of income in the community. It guarantees a reliable source of family income. It is a family tradition, which has been going for many years. Landowners who have additional labourers (because their sons have grown up or their sons-in-law live with them), would use the idle land to plant more rubber trees. It is unlikely that the subsistence farmers would plant trees without having enough rubber trees. Farmers considered having enough rubber trees as one adult male in a household can optimally manage 500 – 600 rubber trees (two hectares). Women and children occasionally work on rubber tree farms managed by men.

Decision Criterion 3 - *Did elephants damage your rubber plantation?*

Landowners who have planted rubber trees would consider planting trees, especially sengon trees (*Paraserianthes falcataria*) as an alternative if elephants kept coming to destroy their young rubber trees or food crops. Population growth and development in all aspects in Riau province have reduced the elephants' habitat that forces them to roam rural settlements. People believed that 'sengon' foliage tastes bitter, so the elephant does not like it. However, landowners would not plant trees straight away if they suffer only from elephants' attack. They must be aware of other benefits of the tree prior to a decision to replace their damaged crops.

Decision Criterion 4 - *Did you learn about benefit of trees from extension workers?*

Paraserianthes falcataria (sengon) seedlings were brought in 1982 by Javanese migrants who planted them as shade around their houses and gardens as part of their home custom. No commercial purpose was put on this species until people learned from forestry extension workers that sengon has commercial value since the plywood companies discovered that this wood is good for plywood core. The forestry extension workers also informed them that logging companies in Riau needed additional supply through timber plantation to meet the local demand for pulp and plywood industries. Along with other species such as acacia (*Acacia macrophylla*), suren (*Toona surensis*) and sungkai (*Fenomena canescen*), sengon was a sought-after tree.

Decision Criterion 5 - *Is your land situated in the areas designated for government or forestry companies' projects?*

To promote tree planting on private land, the Riau Regional Forestry Office used some locations as demonstration plots. Forestry companies that need a secure wood supply also selected private lands nearby to be included in tree plantation projects under partnership system. Both schemes offered the involved landowners cash incentives to grow seedlings and plant them on the selected locations, as well as weed killers and fertiliser. Landowners were certainly happy with this approach. It was much better than having the lands idle with no income. The landowners under partnership system signed a contract that they have to sell the timber to the Company (partner). The landowners will later receive profit only after revenue has been deducted for all the expenses of the company partners.

Decision Criteria 6 and 7 - *Do you have sufficient time to get involved with the tree planting project scheme and get the incentives? and, Do you consider that the incentives are more valuable than your off-farm incomes?*

Having spare time, interested in the planting wage and other project incentives have motivated landowners to get involved with either government or partnership tree planting scheme. Some landowners left their off-farm jobs to take on tree planting.

Decision Criterion 8 - *Does your solidarity to your farmer group keep you involved with the scheme?*

The purpose of forming farmer groups formally was to facilitate the exchange information among the members. However, in reality the establishment of those farmers groups was politically to assist the government to get control over rural areas. They also could be used as government propaganda over a new government programme. Members used to be left with no choice if the head of farmer groups and the village authority decided an option over a government programme.

Decision Criterion 9 - *Do you need something growing on your land to prevent others from using your land?*

Many landowners in the study did not hold government certificate to prove ownership of their lands. They owned the lands according to customary laws. People acknowledged that land has an owner because it was cultivated. Limited accesses to land (forest) caused many people to be hungry for agricultural lands and to use any uncultivated land to grow food crops. Once the unauthorized users utilised a piece of land, it was hard for the original owners to send them away. Therefore, landowners planted the land with rubber, or fruit trees, or anything in order to convince others that the land had owners.

Decision Criterion 10 - *Do you prefer to have high return from your land rather than just enough to fulfil your daily needs?*

Landowners or farmers were always attracted to plant something that they believed would produce a high amount of cash. They usually optimise the use of their land to get higher land productivity especially when they have been able to meet their daily needs.

Decision Criterion 11 - *Are you convinced that trees are profitable, and give you quickest return from your land?*

Landowners learned the advantages of trees from forestry extension workers. They were attracted to plant trees because they were told that trees could be harvested within six years of age for pulp. Rubber trees are tapped at nine years of age, and oil palm start producing good fruits at 11 years of age.

Decision Criterion 12 - *Do you need to secure ownership of your land behind the government tree-planting programme to deter a claim from another party?*

Land encroachment, confusing ownership, claims and disputes over lands were common problems in Riau province. Poor people desperately needed land to survive so they cultivated any land if they had a chance to do that. The land claims were usually from big companies or powerful persons. They were backed up by legal rights to use the lands to establish timber estate or oil palm plantation. Poor people cunningly encroached on the lands by planting them with trees. Later after they had secured access, they planted food crops among the trees. They declared that their action was a result of the government tree-planting programme. The claimers pulled out when they realised that the lands they claimed were part of a government programme. Some wealthier or powerful farmers realised that this tactic worked, so they imitated this practice for commercial interest.

Decision criterion 13 - *Are establishment costs of palm oil beyond your ability to pay?*

Riau people knew already that oil palm was a profitable land commodity. However, the cost to establish a palm oil plantation is too expensive compared to other land use options. A good palm oil plantation requires good seedlings and intensive maintenance. The cost barrier did not apply to farmers whose lands were under palm oil project schemes where the companies carried all the expenses (see *decision criterion 15, Is your land situated inside a palm oil project scheme?*). The partner pays all the expenses, which are accounted as a loan for the landowners. Wealthy farmers who saw this opportunity bought lands in the areas designated for palm oil projects. The original owners turn up to be cheap labourers on their own lands. Some farmers

who were aware of the advantages of palm oil but could not afford to provide the required capital might go for tree considered decision criteria 6 and 8.

Decision Criteria 14, 16, 17 and 18 - *Are free tree seedlings available? Can you afford to buy the seedlings? Do you have time to work on your land? Do you have or can you pay someone to work for you?*

Farmers went for what they perceived as a profitable land commodity. For this they did not hesitate to utilise all resources they had such as land, time, money and labour. They believed that all risks they took now would be worthwhile for them and their families in the future. Wealthier landowners bought tree seedlings and paid someone else to plant trees for them.

4.2.2 How landowners made the decisions

While the above section gives a brief explanation of each decision criterion in the decision tree this section describes the process of the decision. It involves a series of decision-making criteria before landowners decided the best option for their land.

1. Before deciding whether to opt for planting trees or other crops such as oil palm, rubber, or citrus trees, the landowners had gone through an elimination process. Did they have enough land or have more than 0.5 hectares of idle lands or unproductive rubber plantation? If they did not, it was not likely the landowners would opt to plant trees (two cases). However, although they had sufficient idle lands, they would not opt to grow trees if they still needed rubber trees as they had extra labourers in the household or wanted to extend their rubber plantations (nine cases). But, although they considered it necessary to extend their rubber trees and plant their idle land with rubber trees, if elephants kept coming to destroy their rubber plantations, then they would decide to plant trees (six cases). Landowners did not go on to decide in favour of tree planting if they had idle lands, still in need for rubber trees, and had no elephant problem (three cases).
2. Landowners who had lands situated in the tree planting scheme either under government or company project would plant trees (22 cases) because they either:
 - had spare time and adequate landholding
 - were provided with incentives greater than their off-farm income
 - experienced social pressure

Landowners who had sufficient idle lands, were visited and persuaded to plant trees by the forestry extension workers, and those whose lands happened to be in areas designated for either government or company tree-planting projects scheme, planted trees if they had ample time remaining in their daily activities (16 cases). If the landowners did not have time to get involved with the projects scheme because they already worked in urban areas, then they planted trees because they preferred to take the cash incentive that was greater than the wage they received from their off-farm work (three cases). Other landowners planted trees because the neighbours and the head of the farmer group did the same thing. They were afraid of social sanctions if they did not plant trees as suggested by the government (three cases).

3. The forestry extension workers disseminated the news of the benefits of trees and persuaded landowners, especially those who had lands inside the project areas (104 cases). In addition, there were 81 landowners influenced by forestry extension workers who had lands outside the project areas. Landowners still considered planting trees without the forestry extension workers' influence (37 cases). In the project areas, the forestry extension workers visited 23 landowners and 22 of them planted trees. The landowners outside tree planting project areas planted trees and the following decision pathway was taken (45 cases):
 - They needed to grow anything to prevent others from using their idle lands, and
 - They preferred long-term financial return rather than growing food crops, and
 - They believed trees give the quickest return compared to other cash crops.

Or, the landowners decided to plant trees based on the following decision pathway (16 cases):

- They needed to grow anything to prevent other people (encroachers) from using their idle lands, and
- They wanted long-term financial return rather than just growing short-term food crops, and
- They wanted to avoid a claim from other parties because they did not have a valid land title.

Or, the landowners took the following decision pathway to decide to plant trees (four cases)

- They needed to grow anything to prevent other people from using the lands, and
- They wanted long-term financial return, and
- Although they wanted to plant oil palm, growing palm oil was too costly, and
- They were unable to get oil palm project loan because their lands were outside the oil palm project scheme.

4. For those who had land outside tree-planting project areas, and decided to plant trees

(65 cases) may still not plant if:

- No free seedlings were left and they did not want to spend money to buy the seedlings (two cases)
- They could get the seedlings free or did not mind buying the seedlings but they did not have time to plant trees or could not afford to pay someone to do the job for them (two cases).

In summary, the decision tree shows that landowners going down the left-hand side of the HDM were involved in the tree-planting project scheme. They went on to plant trees without constraints unlike some of the other landowners. The model shows that these landowners were motivated to plant trees for one or all of these reasons (time, incentives or solidarity) although there was one case for whom no reason applied and he did not plant trees.

Landowners going down the right hand side of the HDM were self-motivated tree planters. They had more varied reasons (securing land use, long-term returns, quickest profit-making, securing land ownership) to plant or not to plant. Also the model suggests that extension workers played an important role in influencing landowners' decisions. However, landowners with the similar reasons as above might not plant trees as long as they could afford to establish oil palm plantation (31 cases). Those who could not afford to establish oil palm plantation would still not plant trees if they had access to loans at the oil palm project scheme (12 cases).

4.3. Testing The Hierarchical Decision Tree Model (HDM)

Once a decision model is "built" based on interviews with a first sample of decision-makers, it should be tested for accuracy in predicting other choice data. Like any model, there is no point in building it unless one also tests it, to see how good a representation of reality it is (Gladwin, 1989). Because this model is empirically grounded, Gladwin (1989) said that the decision tree model could be tested to see how well it "fit" the observed behaviour of individuals in a group.

As described in Chapter 3, the testing procedure used a questionnaire survey that was conducted in 1999. The questionnaire was simply a list of questions worked out from the decision criteria in the HDM that was built from the 1997 fieldwork. To provide a true test of the model, none of the respondents in the first period of fieldwork were included and the sample test subjects were randomly selected. The questions were mainly close-ended, and simply yes/no questions, which elicited informants' yes/no responses. It consisted of two sections. Section (a) contained questions that asked about factors influencing landowners'

decision-making. Section (b) contained options that were used to examine answers in section (a).

The model was tested for its accuracy with data from 309 additional landowners. The questionnaires were originally prepared to cater for at least 350 respondents. However, only 281 respondents were able to fill the questionnaire during the fieldwork, and 28 filled questionnaires were sent afterwards to the researcher at the University of Canterbury. The 309 filled questionnaires consisted of 64 respondents who planted trees under government supervision, 81 self-motivated tree planters, 58 respondents who planted trees under the partner system, and 106 respondents who did not plant trees. .

In the analysis stage, the 309 responses then were then arranged in the form of tables in such a way that each respondent had his or her own row in the tables to store all answers. Each respondent was assessed to see if, given the answers, actual behaviour fitted the behaviour predicted by the model. In the case of an "error" in the model the informant is never in error, but the model that is in error for not being able to explain the choice of behaviour of the informant.

4.3.1 Testing the model

To determine the accuracy of the model, testing produced an error if the model predicted a respondent planted trees but actually he did not or vice versa. While identifying errors, the testing procedures also calculated the number of respondents who made a certain decision pathway. All had to be done manually because there was no ready computer programme available for this purpose. Figure 5 on the next page depicts the results of testing the HDM and the following paragraphs provide the detail for every decision pathway including how many respondents did or did not (error) follow the decision pathways as predicted by the model.

1. Before planting with trees or non-trees 304 landowners agreed that they used to have idle lands of more than 0.5 ha. Five of them said straightaway that they did not plant trees because they considered it economically unfeasible planting trees for pulp and timber without sufficient land to grow (Criterion1). Therefore, they planted food crops that were more useful for their family.

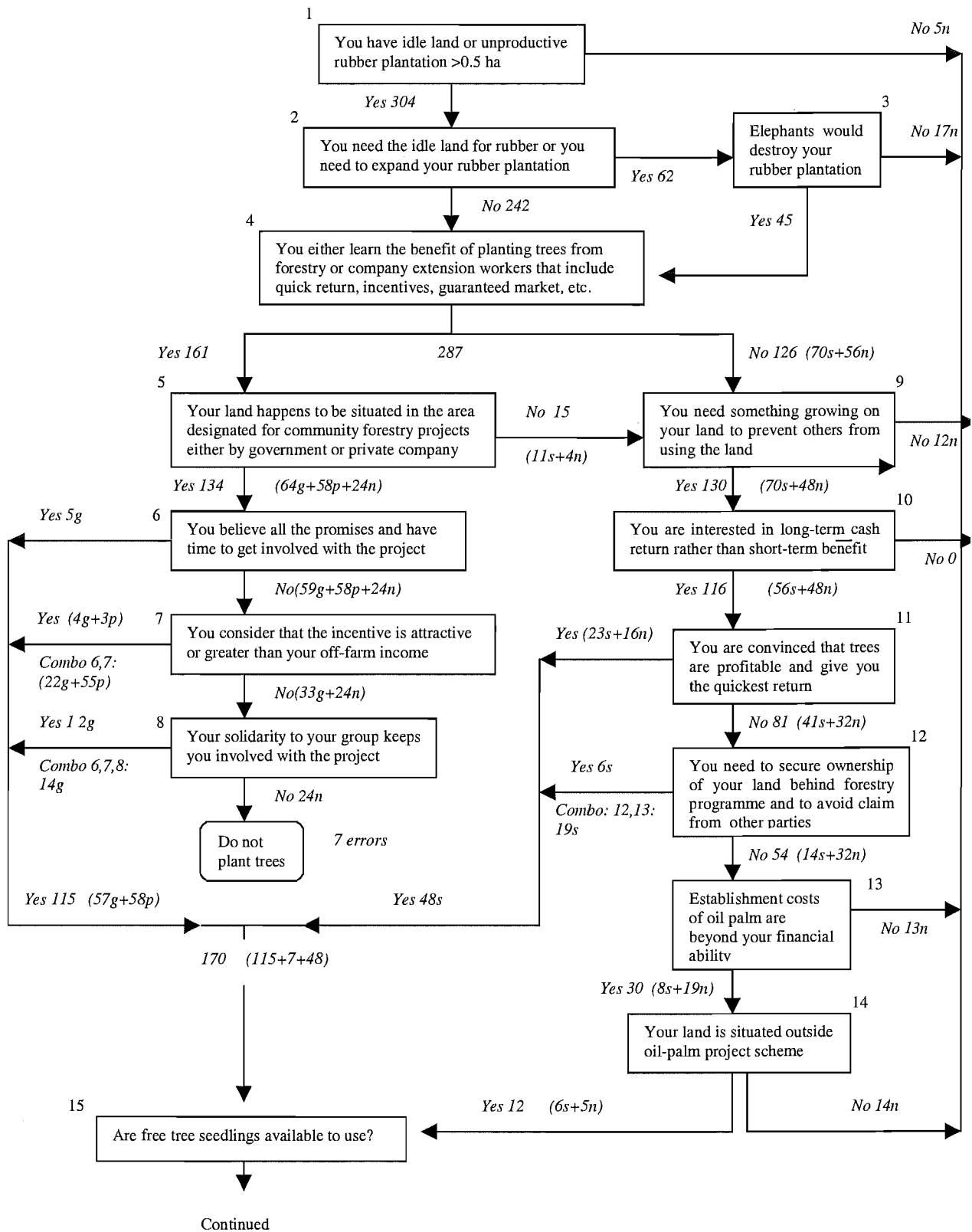
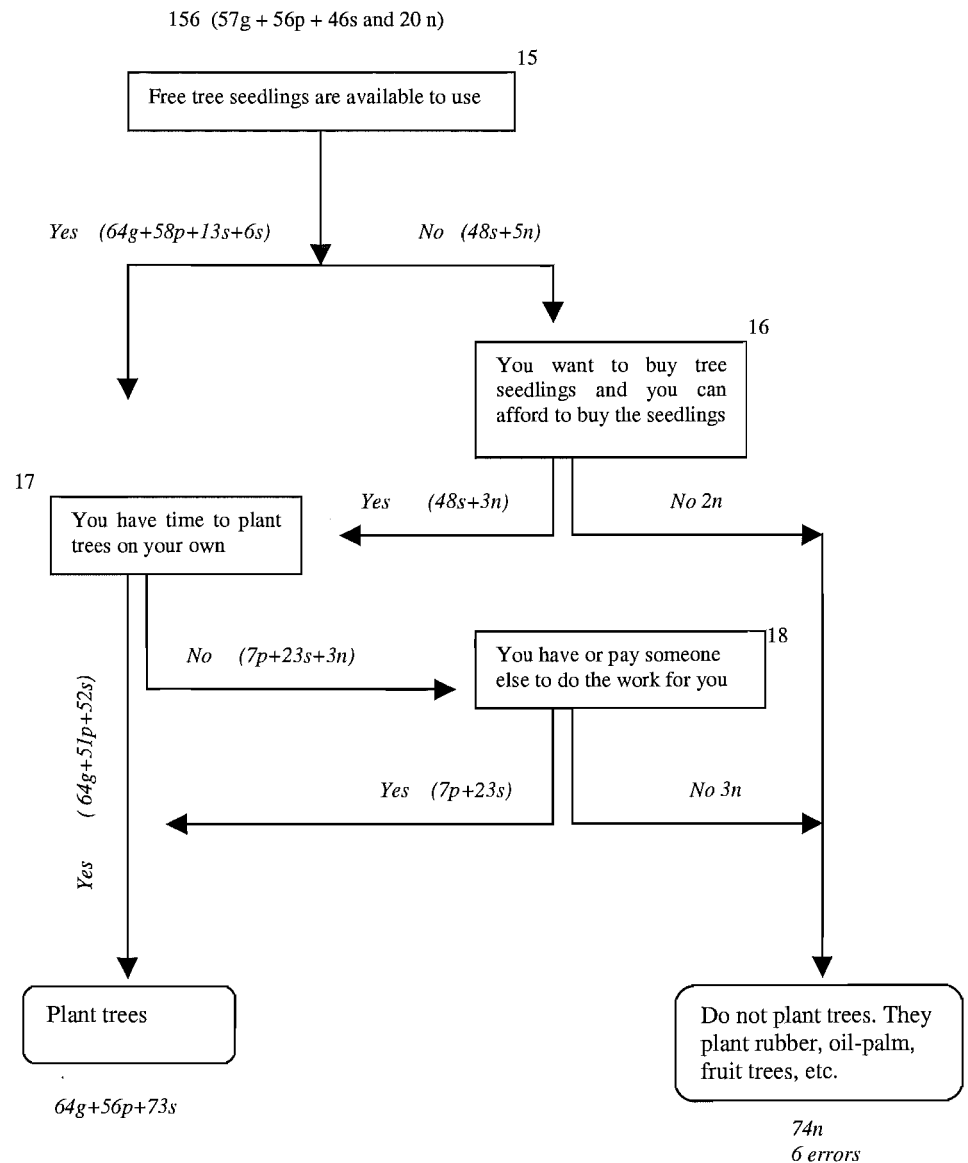


Figure 5: Testing the HDM regarding tree planting in Kampar region



Total errors: 56 errors out of 309 cases

Symbol:
 g = tree planters under government project
 p = tree planters under partnership system
 s = self-motivated motivated tree planters
 n = non-tree planters

Figure 5 (continuation): Testing the HDM regarding tree planting in Kampar region

2. Of 304 landowners, each with more than 0.5 ha idle land, 62 landowners who planted and did not plant trees said that owing its advantages they needed the idle land to plant rubber trees or to expand their existing rubber plantation (Criterion 2). The rubber trees grew undisturbed so 17 landowners went ahead with planting rubber trees on their idle lands. Errors occurred in this decision pathway because two landowners were found to have planted trees although they said they wanted rubber trees. The model predicts landowners do not plant trees if they still want rubber trees. These two were Javanese migrants who were granted 2 ha land each by government policy. According to the 1982 Riau Transmigration Resettlement Act, the Javanese migrants were not encouraged to plant rubber trees on their granted lands. They were supposed to bring in a wider choice of land cultivation as a model for Riau people. They were expected to grow food crops such as rice, corn, cassava, fruits, etc. These two decided to plant sengon trees because they were left with no option since rice or corn did not grow well on their lands, and in their original island (Java), they planted trees for multiple purposes.
3. The 62 landowners still wanted rubber trees and they planted them (Criterion 2). Unfortunately elephants destroyed rubber trees owned by 45 of them (Criterion 3). The results show that 23 farmers with the destroyed lands learnt the virtues of trees from the forestry extension workers (Criterion 4). They also planted trees under government project because their land happened to be situated within the project areas (Criterion 5). They believed that sengon trees were free from elephants' destruction.
4. The testing showed that 242 landowners had enough rubber trees, and did not need more rubber trees (Criterion 2). Among those 242 landowners, 149 learned of the benefit of trees from the extension workers either from the forestry office or company while the other 138 landowners answered that the extension workers had never persuaded them to plant trees (Criterion 4).
5. Among those 149 landowners who learned of the benefits of trees from extension workers, 134 owned land situated inside the tree-planting project scheme either under government or partnership system (Criterion 5). Precisely 64 people planted trees under government project, and 58 people planted trees under partner system. The remaining 15 landowners had their lands located outside tree-planting projects.
6. Five out of 64 landowners under government project planted trees because they had sufficient time to get involved with the project and took the planting wages (Criterion 6).

Among 64 landowners inside the government tree-planting project areas, 22 decided to plant trees for combined reasons (a combination of Criteria 6 and 7). They had sufficient time to get involved with the project, and took the planting wages that they considered worth more than the money that they usually earned off-farm. Four landowners answered that they actually did not have time to plant trees because they did a labouring job somewhere else, but they were lured by the higher wages to plant trees (Criterion 7). There were 14 landowners who decided to plant trees under government project because of combined reasons (combination of Criteria 6,7,8). They had sufficient time, took the planting wage, which was higher than their off-farm wages, and were loyal to their farmer groups.

7. Among those who planted trees 12 landowners inside the government project areas responded that trees were difficult to market, and the provided incentives did not encourage them to plant trees (Criteria 6,7). They also had other activities after slashing their rubber trees. However, they planted the trees over the weekend because they were members of farmer groups (Criterion 8). They believed that by being a member of a farmer group they would continually receive necessary facilities from the government. The ruling party Golkar used to exploit farmer groups to spread its influence as well as to maintain its power in rural areas. In return Golkar gave them free agricultural seeds, seedlings, free fertiliser or weed killers, tools, electricity generators, clothes, or even built irrigation systems for some of them.
8. Within the decision pathway of 6,7,8 there were 55 landowners who said that they participated in company tree-planting projects because of two reasons (combination criteria 6,7). They had time, were interested in the guaranteed market promised by the company partner, as well as the incentives offered by them. While three people answered that they did not have time to get involved with the project due to other commitments, they were lured by the offered incentives such as fertiliser, weed killers, and food-crops' seedlings.
9. Within the decision pathway of 6,7,8 there were 12 landowners who did not plant trees although their lands were situated in tree-planting projects. They were not convinced that tree-farming practices were profitable. They were not attracted by the offered incentives since they had reliable sources of income. They did not belong to any farmer group so they did not bother with solidarity among farmers, or worry that the community might impose sanctions. They were wealthy landowners, and had resources (money, manpower) to grow something they considered a more profitable land commodity, such as oil palm.

10. Seven errors had been found in the above decision pathway. Seven landowners inside government project declared that they neither believed that tree-farming was profitable nor were interested in the offered incentives (Criteria 6,7). They were not concerned with solidarity (Criteria 8) as they responded that it did not affect their decision in planting trees. However, these farmers were worried about sanctions that might be imposed by the surrounding community. It was disclosed that the forestry extension workers indicated that the government might grant land certificates on any land planted by trees under a government project because this activity was part of a long-term forestry development plan. The land certificate would be issued in-group or in a collective way, not per individual basis or partial. Accordingly, any individual who is not complying with this programme might thwart other community members in acquiring such a certificate.

11. Within the decision pathway made by landowners outside tree-planting project areas, there were 138 landowners who were not approached by the extension workers and 15 landowners who learned of the benefit of trees from the extension workers, making a total of 153 landowners. Among these 153 landowners, 130 agreed that they needed something growing on their lands to prevent others from using their lands without their consent (Criteria 9). There were 12 landowners who were not worried about land encroachments, so they left their land unplanted. They were part of 18 landowners who had crops destroyed by elephants and they intended to replant their destroyed rubber when they had time. Eleven errors were found because the model predicted that these people would not plant trees if they did not need to protect their land. However, 11 landowners still planted trees although they did not need to protect their land from squatters because these people still allowed their landless neighbours to get access to their lands to gather firewood or to grow a few herbs for traditional medicines. Nine of these landowners lived only 15-30 minutes walk from their tree plantation.

12. The model predicted that some landowners might not plant trees if they were not interested in long-term cash return (Criterion 10). However, the test found 11 people who planted trees although they were not interested in long-term benefit. The 11 tree-planters claimed that they grew sengon or acacia because they believed forestry extension workers who said trees could be harvested in 6-7 years. Accordingly, they thought that they could get the benefit earlier from the trees compared with rubber trees that have a maturity period of 9 years.

13. The results produced 23 landowners who were convinced that trees were profitable and enable them to get quick return (Criterion 11). However, six landowners were not convinced of the possible economic benefit from trees, but securing their hold on the lands through participating in forestry programme was their reason (Criterion 12). The six landowners believed that other parties would not have the courage to take possession of their lands if they were carrying out a forestry programme. The test also found that 19 landowners had a combination of decision criteria 11 and 12 (economic reason, and land holding strategy behind a forestry programme) in their decision process to plant trees.

14. The test shows 40 landowners needed to grow something on their land to prevent others from using their lands (Criterion 9). They were also interested in long-term cash return (Criterion 10). However, they believed that trees were not profitable in the long run, and incomparable to rubber trees or oil palm (Criterion 11). They never had any claim on their lands, and they never had any doubt over the possession of their lands, partly or as a whole property (Criterion 12). Among these 40 landowners 18 planted oil palm when they considered that oil-palm was economically the best choice, and they could afford to purchase the oil-palm seedlings (Criterion 13). The remaining 22 landowners said that they could not afford to grow oil-palm but 17 of them grew oil palm because their lands were situated inside the oil- palm plantation scheme (Criterion 14). The HDM made two errors in this pathway because two landowners planted trees although they had been persuaded by the oil-palm plantation contractor to participate in the scheme. They did not want to give their land certificate to the contractor because if the oil-palm plantation failed it would be hard to get the certificate back from the Bank, since it had been held as financial security. Six landowners preferred to go for trees to meet criteria 9, 10 although they said no to criteria 11,12. They were concerned about the establishment costs of growing palm oil while tree seedlings were available for free. Two landowners could neither afford to buy oil-palm seedlings nor had free tree seedlings, and they did not want to spend any money for tree seedlings (Criteria 16) so they ended up with planting non-trees. Three landowners did not mind buying tree seedlings but they had no time to plant trees (criterion 17). They did not have anyone to help, and they could not afford to pay labour (Criterion 18), so they did not plant trees.

15. The landowners who planted trees under either government or company projects had access to free tree seedlings. While self- motivated tree planters, four landowners had access to free tree seedlings and 44 landowners had to purchase them (Criterion 16, and 17). Time was also a constraint in tree planting (Criterion 18). There were 6 self-motivated tree planters who said that they had or paid someone to plant and to take care of the trees.

16. The test found six errors in the decision criteria 10 to 14. The model predicted that they would not plant trees if they did not believe that sengon or acacia trees were profitable, but they actually did. These people were Javanese who migrated to Riau in 1982. Before coming to Riau they used to plant trees in their homeland for many purposes such as fuelwood, shade, soil fertiliser, boundary marking, protection, timber for domestic use, etc. These Javanese people regarded trees as part of their culture, a symbol that could bring them life and luck.
17. The model predicted that people might plant trees if they said yes at criteria 10,11,12. However, 20 errors were found because they did not plant trees. They indeed believed that tree farming is a profitable land use in Riau, but still in many years ahead in the future. As long as the natural forest in Riau is still able to supply raw material to local wood industries, it will be difficult to find a market for plantation timber, except if the government guarantees the timber market.

4.3.1 Results of the testing

The HDM formulated in the first period of fieldwork in 1997 was able to predict 57 landowners who planted trees under government project, 58 landowners who planted trees under the partnership system and 12 landowners who did not plant trees (decision criteria 5,6,7,8). The number of errors found in this decision pathway was 12. The HDM predicted 48 samples of self-motivated tree planters (decision criteria of 9,10,11,12), with 20 errors found. Within the decision criteria of 9,10,11,12,13,14 the HDM predicted six landowners as self-motivated tree planters, five landowners as non-tree planters, and two errors were found. In predicting the non-tree planters, the HDM predicted 86 cases, but the model made 36 errors. Hence, as a total the model was able to predict 253 out of 309 respondents or it had an accuracy of 82%. This result is only slightly lower than 85 – 90% accuracy of an appropriate model specified by Gladwin (1989). The research then modified the formulated HDM to accommodate the errors.

The altered but untested HDM as seen in Figure 6 provides a better accuracy of 87% by replacing the decision criteria in the original model. Therefore the original decision criterion 10 in Figure 4 – *Are you interested in long-term cash return rather than short-term benefit* was removed. This modification allowed the model to fix the 14 errors in the Figure 5 that shows no landowner planted trees who was interested in long-term return. The altered model in Figure 6 put a new decision criterion 9 – *Are you worried about not getting the promised land certificate*. This decision criterion was intended to address seven errors in Figure 5 who still planted trees although they were not influenced by project incentives and farmers solidarity.

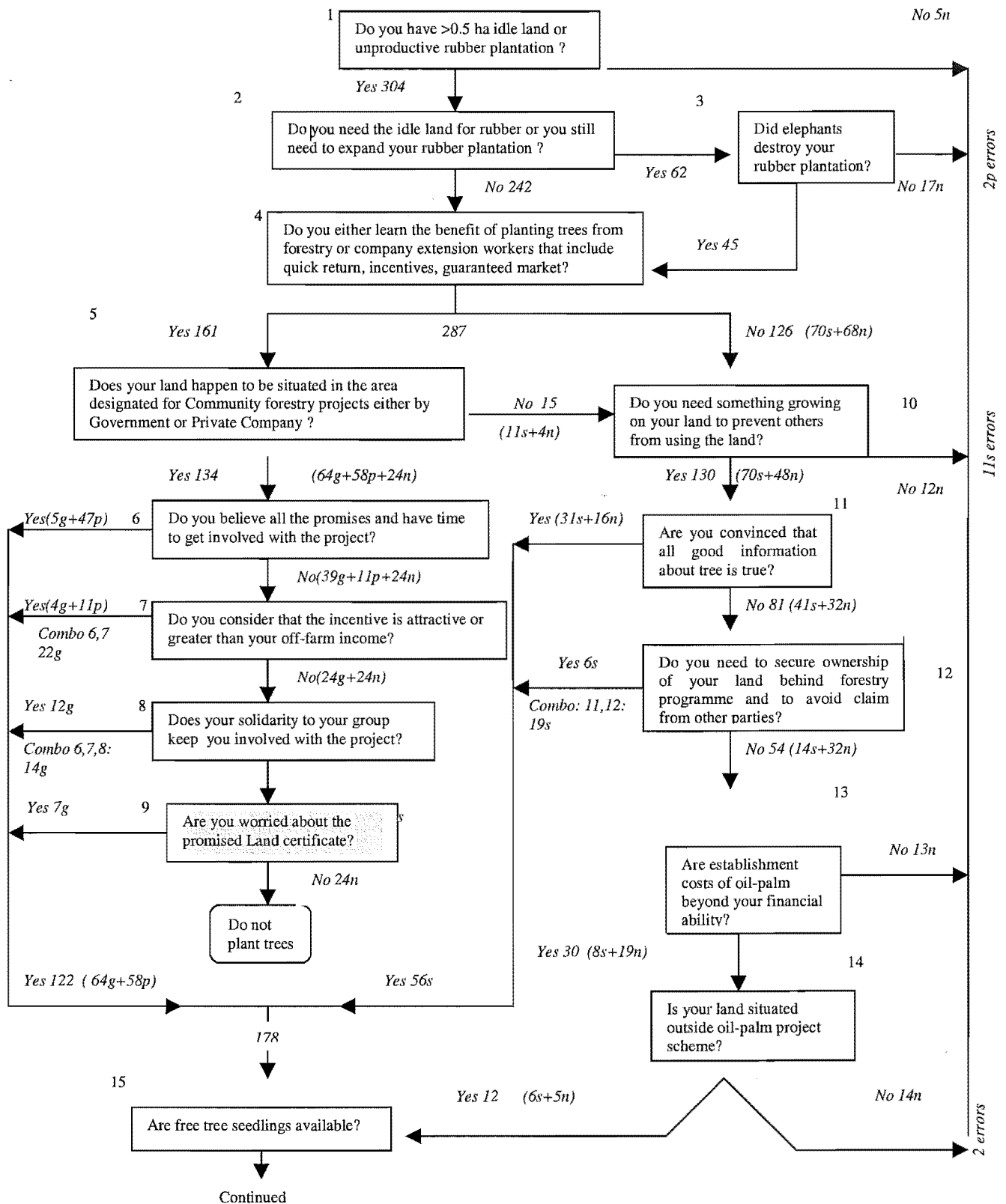
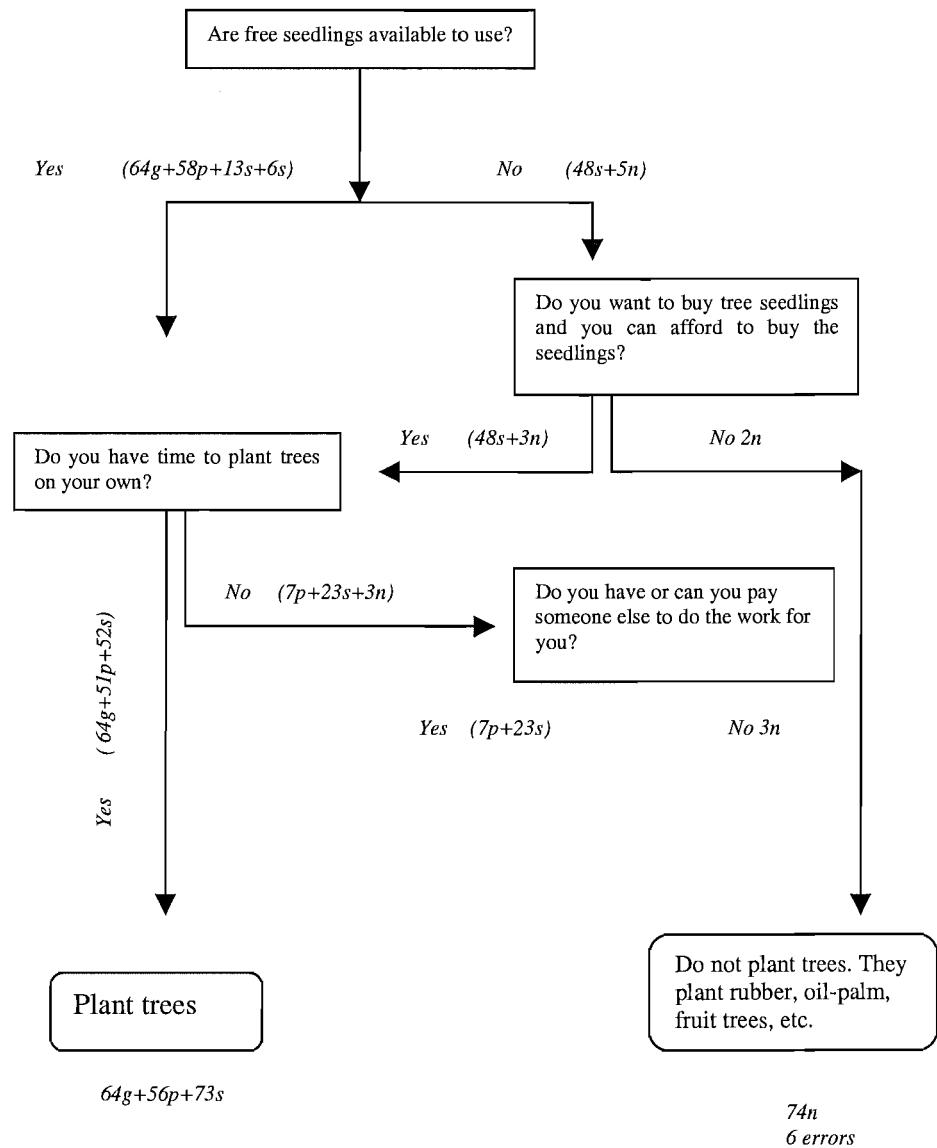


Figure 6: Altered but untested Hierarchical Decision Model regarding tree planting in Kampar region, 1999

Continuation

Total errors: 41 errors out of 309 cases

Figure 6 (continuation): Altered but untested Hierarchical Decision Model regarding tree planting in Kampar region, 1999

4.3 Combined Results from Qualitative and Quantitative Approaches

The previous sections presented the research results of modelling landowners' decision-making regarding tree planting in the form of a hierarchical decision tree model (HDM) formulated through a qualitative approach. The above sections also provided the results of the model testing to determine the model's accuracy. It has been mentioned earlier that the research also gathered quantitative data through a questionnaire survey for model testing. These quantitative data were analysed separately and the results are presented in combination with interview data.

This section explains in detail and in a comprehensive way each decision factor in the HDM, identifies precisely the reasons and constraints regarding tree planting backed up by the results obtained from quantitative analysis. The outline of this section follows the structure of the HDM such as why the tree planters used their idle land, why they did not need rubber trees, why they joined the tree planting project, and the importance of the forestry extension workers' role. These results also include the role of incentives, solidarity among members of farmer groups, the use of trees as ownership identification, economic benefit and the perceived tree market. This section also gives detailed results on the use of trees to get access to state land, and explains why some landowners rejected the idea of planting trees.

4.4.1 Idle land

Without sufficient land, people would not grow trees. Seventeen respondents who were interviewed in stage 1 used the words *idle lands*, *spare lands* or *uncultivated lands* as the opening answer to the questions about why they planted trees. Based on these 17 responses, the research regards this factor as important in the decision process to plant trees.

There were also 66 other respondents in stage 1 who said that the lands where they grow trees were initially idle. The following were some typical answers, which all show that the presence of idle land was important in their thought.

"I used to have a hectare of idle land, which was part of my rubber tree plantation. The forestry extension workers came to me with the story of the virtues of sengon trees (Paraserianthes falcataria). They assured me that sengon trees would give a quicker return compared to what I get from rubber trees. While rubber trees usually reach their maturity at year nine, they said sengon trees could be harvested and sold at year six or seven".

"I am not convinced that trees are a profitable land commodity as the forestry extension workers said. Riau's forest is large enough to give us timber but doing business is like gambling. They said that sengon and acacia trees are valuable for pulp. Who knows it might be true? So I used two hectares of my unattended land to grow trees. I still have my rubber trees; my family can count on them anyway".

"I heard that some people in the Kampar region have planted sungkai trees (Fenomena canescen). It is a high-quality timber indeed, and they do not have to spend so much time looking after the trees. Sometimes they only tend the trees on Sunday. But that tree takes at least 35 years to harvest. I do not think I can wait that long. Sengon might give a return in a relatively shorter time. However, I am still unsure of the prospect of this tree. Moreover, planting trees is still a new practise for my family, and I expect trees will be as profitable too as my rubber plantation. So planting sengon on my 2.5 ha idle land is a good start. At least the trees will make my land productive. Sengon trees are easy to plant and they grow well. I saw some people doing the same thing, so it is worth a try."

The forestry extension workers in 1997 proudly told the researcher that planting trees for timber production was gaining momentum. More and more landowners participated in tree planting, even those who lived outside the government project areas. The forestry extension workers presented the indicators of success such as the increased demand for tree seedlings, and the conversion of rubber plantation to trees. However, field observation proved that the landowners only cut and burnt the old and unproductive rubber trees, then cleared the lands and planted with tree seedlings mainly sengon trees.

"The land that I am using to grow trees was idle and uncultivated. My old and unproductive rubber trees used to stand on this 1 ha of land and required some expenses to regenerate them. Therefore, when the forestry extension workers told me that acacia and sengon are able to generate profit in only six or seven years time, I considered growing trees. I was interested to learn that I did not have to buy the seedlings because the extension workers provided them."

A factor that directly influenced farmers' decisions to plant trees was clearly that of the availability of existing resources such as land. Growing trees was a new adoption in Riau province, and logically it can be associated with some important risk factors. Farmers and landowners were happy to use their idle lands since they faced uncertainty about trees. Inadequate market information, insufficient knowledge of the timber business, and a long gestation period may be seen as components of their uncertainty about the benefits of planting trees.

Seven absentee landowners who lived in the capital city, Pekanbaru, also had a typical answer recollecting their decision to plant trees on their property.

“I bought this four ha land last year from a villager at a very cheap price compared to the ones in Pekanbaru. It was idle land. In this current situation, it is unwise to leave unattended land while living far away from the land. Hence I considered growing anything to show that the land has an owner. I was tempted to grow sengon trees because some people said that this tree is profitable. I believed them because I saw people in the neighbouring villages where my land is located also planting sengon trees. I bought the seedlings and I asked someone working for me to plant them. I did not mind the price he asked for doing the job. I think growing trees is the best option for my land. I am happy to be looking after my land without fear that someone else might use it. It is really fun to take my family there in the weekend as my new recreational destination. I do not care whether the tree itself is marketable or not, although I believe that trees will be profitable in the future. Every one needs timber”.

“This six ha land was idle when I bought it for investment purposes. The person whom I assign to look after the land suggested that I should cultivate it. When he came up with the idea to plant sengon trees together with rubber trees, I just said go for it. I do not object to the cost of the planting, and I do not want to put up with the crop I have to grow. I live far from my land. Therefore, I must consider who is going to supervise it if I grow food crops or oil palm”.

The use of idle lands is underlined by the survey results. Figure 7 shows that 95%, 89%, and 81% of landowners who planted trees under government project, were self motivated, or under the partnership-system respectively admitted that they planted the trees on the lands that used to be marginal, idle, unused or unproductive site. There is a relationship between the use of idle land for planting trees with the tree planter groups $\{\chi^2(df=2, n=204) = 6.21, p = 0.04\}$.

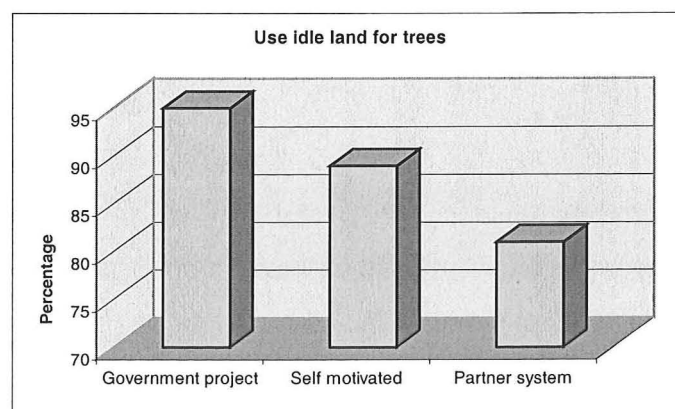


Figure 7: The use of idle land for planting trees

Pressures on labour and other resources increased due to job opportunities in the urban areas and the increased prices of fertiliser, weed killer, insecticides, etc. Consequently farmers abandoned their poorer or more distant land or put them under less intensive use, in favour of concentrating the use of available inputs on the more favourable sites. When the government introduced trees as an income opportunity, they automatically used their idle land. As part of land use strategy, they made decisions wisely on where the trees should be planted in order not to impede their existing profit generation. Observation during fieldwork showed that in general, the locations of tree plantations were considerably further away than their rubber plantation or their food crops. The survey results in Tables 15 and 16 show that there is a significant difference of tree location distance from home among the groups, $\{\chi^2(df = 3, n = 309) = 22.85, p = 0.001\}$. The highest percentage of landowners taking more than 60 minutes by motorbike from home to their trees was the self-motivated tree planters. (*Note:* Non-tree planters were measured from their home to their farm).

Table 15: The Distance from Home to Tree Plantation.

Groups	Distance achieved by motorcycle		T o t a l
	< 60 minutes	> 60 minutes	
Government project	48 (18.68%)	16 (30.19%)	64
Self motivated	59 (22.96%)	23 (43.40%)	81
Partnership system	58 (22.57%)	0	58
Non-Tree Planters	92 (35.80%)	14 (26.42%)	106
T o t a l	257 (82.90%)	53 (17.10%)	309 (100%)

Table16: Distance to Trees Plantation among the Groups

Groups	Mean distance (minutes)	T group	Remarks
Government project	26.95 ± 2.65	B	Means with the same letter are not significantly different. $\alpha=0.05$ df= (3, 306)
Self-motivated	36.40 ± 3.15	A	
Partnership system	12.15 ± 0.85	C	
Non-tree planters	23.73 ± 2.15	B	
F	14.16		
P	0.0001		

With the assumption that idle land is usually located far from the owners' homes, Tukey's Least Significant Difference (LSD) test in Table 16 above shows that trees planted by the self-motivated tree planters were significantly the farthest among the groups. The trees planted under the partnership system were significantly the closest to the owners' home among the groups. Unlike the other two groups of tree planters (government project and partnership system), the project incentives did not influence the self-motivated-tree planters. Therefore, they used their undesirable land location to grow trees since they faced uncertainty about the tree benefit of the trees.

Meanwhile during the first period of fieldwork five landowners said that they had limited land resources so they preferred to grow food crops rather than trees. The following is the typical answer as to why they did not grow trees.

"I do not think farmers in this village grow only trees on their land except for the well-off landowners. How can we survive until the first harvest if we only rely on trees? I am not sure either, whether my family can live on trees alone. I do not have spare land to grow trees. I grow fruit trees and food crops on my land."

Landowners who chose not to plant trees had different perceptions about how to make their idle land valuable. The simple statement below is a typical explanation by those who planted oil palm, which was given by 17 respondents during the stage I field work.

"I had spare and idle land. I planted oil palm on it because I saw that oil palm is a profitable crop. It is normal here, for a farmer like me to choose the most beneficial land use option. I do not plant trees if I am unsure whether trees are easy to sell, and when I can sell them."

Having idle lands was a factor that stimulated people to plant trees. However, the landowners did not always plant the idle lands with trees. It was common during the interview in phase 1 fieldwork for non-tree planters to express their concern over the disadvantages of tree planting. Their reasons might include potential risk factors such as failure to achieve expected levels of return because of uncertainty of markets and timber prices, and high potential costs of tree harvesting including transport costs and the complicated bureaucracy to get permission to harvest the trees. The survey found that the perceived risks of planting trees were no market (58%), long gestation period (25%), low return (5%), and other things (12%).

4.4.1 The need for rubber trees

Rubber resin is easy to sell and it has a good market in Riau province. Rubber farmers tap the resin everyday; when the rubber trees are ready to tap from age nine or ten. This production pattern enables rubber farmers to cash the product immediately. Rubber trees require low maintenance costs, and almost every farmer in Riau can afford to grow them. The logo of the Kampar region uses a rubber tree as a symbol of people's prosperity.

Rubber tapping had been practised in Riau for generations. The resin can be quickly turned into cash as the farmers sell the resin to traders who are also members of the community. In the rainy season, when rubber tapping cannot be done, the communities owe some money to the traders for their daily consumption, and they will pay off the debt with rubber resin. Children also work on rubber tapping. In one day a girl can tap about 30 rubber trees from 7 to 9 am. In the same time an experienced adult male can slash about 500 trees in two hectares.

Rubber tapping is an activity that is dependent on weather conditions. In the dry season, a person can produce 5 kg per day from about 500 trees. Within a month with 20 – 24 days work a person can produce 100 – 120 kg of rubber resin. In the market, rubber resin is sold at Rp. 1,000 – Rp. 2,000.- per kg. Therefore a household earns approximately Rp. 100,000 – Rp. 200,000 per month (US\$ 50 - US\$ 100 in 1997). However, in the rainy season the earning might drop to Rp. 30,000 per month.

Younger plantations (6–8 years) produce less resin. If the average number of rubber trees per hectare is 500, on one hectare a person can produce only 3 kg a day or 60 kg a month with total earnings approximately Rp. 60,000. Rubber is the main source of income. It is unlikely a subsistence farmer would plant trees without having rubber trees on his land. Landless farmers could still enjoy the benefit from rubber trees with the sharing system.

Considering the importance of rubber trees in the farmers' economic life in the Kampar region, it is understandable that they put growing rubber trees as the first priority if the land is available. The decision tree model (HDM) demonstrates that landowners were willing to plant timber trees if they had an adequate amount of rubber trees. Below are some examples of explanations from interviewees who planted trees.

"I have more land compared to my neighbours. I have planted the land with a lot of varieties from rubber, oil palm to annual crops. The forestry extension workers suggested I utilised two hectares of my land to plant timber trees since it was untended. We got free seedlings, and we hope the trees will be marketable."

“I grow two hectares of rubber trees in my two and half hectares of land. I used to finish tapping rubber trees by 9 a.m. and have no other work to do after that. Rubber trees will not produce good quality resin if we tap them after 9 a.m. I have planted trees on my 0.5 hectares of land because the head of the farmer group asked me to plant sengon and acacia trees. He said that they are marketable”.

“I have a hectare of land that was unattended. I do not need to grow more rubber trees because I have someone to look after my three hectares of rubber trees based on a 60:40 profit share. I also have a regular income from off-farm work. I heard from friends that landowners in Pasir Pengarayan village are able to sell their timber trees to some forestry companies. So I plant sengon trees because I believe that timber is profitable and growing trees requires less time than tending rubber trees”.

On the other hand, the quotations below came from three interviewees who disclosed that people put a higher priority on rubber when they have adequate resources such as time and labour. The reason sounds quite simple and logical since rubber has proven profitability.

“I used to have a hectare of idle land adjacent to my two hectares of rubber plantation. My nineteen-year-old son-in-law lives with us. I can expand my rubber plantation because we work together now. One day I might consider giving him and his family part of my rubber tree plantation.

“I do not want to risk my land with uncertainty. Some of my neighbours started planting their lands with sengon trees, but my family is used to living on rubber. Rubber gives us a regular family income. I recently regenerated my old rubber plantation, and I planted more rubber on some of my spare land. I have not decided what I am going to do with the remainder of my spare land. I considered that planting trees is a desirable land use option. But, I think it is better to expand my rubber plantation. We hope to have more income from planting more rubber. The middlemen come regularly to our village to buy our rubber sap. I know them very well, and I often borrow some money from them if I am short.”

“I used to have idle land, but I grow rubber trees of course. The resin price is low nowadays. The forestry extension workers told me that timber trees are profitable. However, we have proven for years that rubber trees are, it gives us a regular and reliable income for my family to live on it. Planting rubber trees is not difficult either. I use the money from selling resin to buy my daily necessities. There is no way to plant trees since I do not know the advantages of trees. Trees grow naturally so there is no need to plant them. If we need poles or timber, we just go to the forest. If I do not chop the trees today, someone else might do it tomorrow.”

Above all, it is likely that Kampar people found the rubber plantation as an appropriate strategy to meet their subsistence needs. Villagers in Kampar region traditionally run a local market every week throughout the year. This tradition is part of the prevailing agricultural season in this region. Some agriculture crops could be harvested each week, some would be in every month, or some had to be once a year. Accordingly, people who were living in this system had adjusted their needs to what they could produce. They wisely divided their needs into three phases, immediate (weekly), medium (monthly), and long term (yearly) needs. The weekly needs were rice, coffee, tea, tobacco, etc. The monthly needs were seasonal agricultural products such as fruits, spices, etc., and annual needs were clothing and appliances especially in Ramadan the holy month for Moslems, and school fees. Therefore, if a farmer should manage his resource in order to generate income that can be spent during the market days, rubber resin was apparently able to provide it. At least the sale from rubber resin enabled him or her to meet weekly and monthly needs.

Meanwhile, the survey results shown in Figure 8 demonstrate that 30% of tree planters under the government project still needed to plant rubber trees, and 33% of tree planters under the partnership system still wanted rubber trees. Sixteen percent of landowners who did not plant trees admitted that they still needed rubber trees, while self-motivated tree planters had the lowest percentage at only 8.5%.

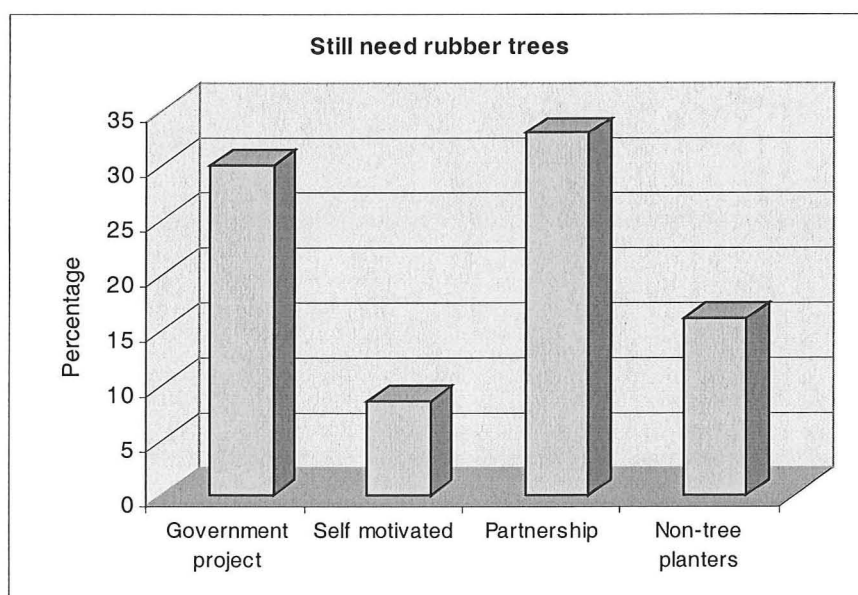


Figure 8: Percentages of landowners who still need rubber trees

More tree planters under government projects and the partnership system said that they still needed rubber trees than non-tree planters or self-motivated tree planters. This is an indication that project incentives had a strong influence motivating their decision to planting trees. The government as well as the company partners provided incentives to tree planters such as cash, weed killer, and fertiliser. The landowners may have regarded these incentives as important to help them to grow food crops, as they thought that food security was more precious than the advantages of rubber trees in the short run. Self-motivated tree planters are considered not to be motivated by any project incentive since their tree plantations were outside the tree planting project scheme. In general the self-motivated tree planters had enough rubber trees growing on their most favourable lands. Considering the availability of inputs such as labour and time, trees were the best option to plant on their idle lands.

4.4.3 Elephants destroyed rubber trees and food crops

Increased population has contributed to the widespread settlement of farming areas as well as other land uses in the Kampar region. Heavy forest exploitation by commercial logging companies and the expansion of oil palm plantations has destroyed elephants' habitats. Consequently, elephants rampage human settlements searching for food in areas that were previously in their territory. People gradually learned that sengon trees could be planted in areas prone to elephant infiltration, and believed that elephants did not like the taste of sengon leaves and branches. The extension workers spread this good news, hoping more people would be interested in planting sengon trees on their private land. Below are typical accounts recorded from interviewees who decided to abandon the lands because of their experience with elephants.

"I needed to expand my family rubber plantation so I planted some of my idle land with rubber trees. Every time the elephants came, they destroyed my plantation. The elephants also ransacked the neighbouring rubber trees, especially when the trees were less than three years old. I also planted food crops along, but elephants eat them all. I do not know how to overcome the problem. All I can do is watch the herd ruin my crops."

"This village has had no problem with the elephants in the past. I do not know why they recently came to our plantations and ate them. The animals must be starving and they desperately needed some food. I suspect that they have insufficient food left in the jungle. The elderly people in this village told me that in the past they used to see elephants walking across our rubber plantations but they did not do any damage. Further, they told me that they used a traditional way to send them back to the jungle. They brought with them anything that could

produce noise such as gongs, drums, utensils, torch, and even banana leaves to scare the elephants off. But today elephants are different. The big males keep staring at us, standing still, and are ready to attack when we get close to them. They are no longer afraid of us. Elephants killed two people from neighbouring villages when they came across the herds. The elephants did not only attack our plantations, they also rampaged oil palm estates although the companies have built electrified fences surrounding their plantation”.

There were three interviewees who planted their damaged property with sengon trees, although they actually still wanted to grow more rubber trees. Two of them said:

“Before I grew trees, elephants used to destroy whatever I planted. Now, the herds still come, roaming around, but they do not eat the trees. The sengon trees probably taste bitter. At least I have no bother with the elephant anymore. I have also heard that other people’s land planted with trees is left untouched when the herds come. Therefore, we recommend people grow trees if they have a problem with elephants”.

“There are other potential pests that can destroy our crops such as boars and deer, but usually the villagers can handle them. If we managed to kill boars or deer, we could sell them easily. Hunters from Pekanbaru often come visiting our plantations. However, no one dares to shoot elephants because the law protects them. I could go to the forestry office for help but it would be at some cost since we have to hire their trained elephants. So I have given up my rubber trees for sengon trees.”

Three interviewees planted more rubber trees because their lands were undisturbed by the elephants although they realised the danger. The following is their typical explanation.

“I have heard that people are having problems with elephants. Their plantations may be located in the areas close to the elephants’ home range. But, I have no trouble with them so I still plant rubber trees whenever possible”.

The previous analysis of distance from home to trees presented in Tables 15 and 16 showed that trees planted by self-motivated tree planters were located significantly farther away than trees planted by the other two groups (government project and partnership system). These results indicate that the location of trees planted by self-motivated tree planters tends to be in remote areas, where they can be assumed to be close to, or part of the elephants’ territory. The trees planted under the partnership system were relatively close to the villages (Mean = 23.72 minutes by motorcycle) so it can be assumed that the elephants may not have the courage to get close to resettlement areas.

The survey also shows that before planting trees, more self-motivated tree planters had experience with elephant damage. Thirty-two percent reported elephant damage compared to 25 percent for the government project group (Figure 9), and 18% for non-tree planters. No tree planter under the partnership system said that elephants had ever destroyed their crops. Although there was no significant difference among the groups on the percentage of those who had a bad experience with elephants ($\chi^2 = (df=2, n=252) = 4.02, p>.05$), Table 17 shows that in terms of area, self-motivated tree planters had a significantly higher total of damaged crops compared to the other groups of tree planters. $\{F = (df=2, n=109) = 4.23, p=0.017\}$

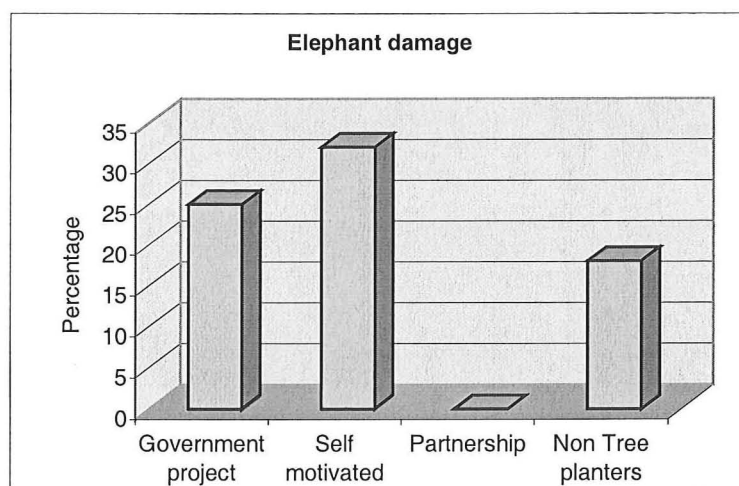


Figure 9: Landowners who had experience with elephant damage.

Table 17 Food Crop and Rubber Tree Destruction by Elephants

Groups	Damaged area (Ha)	T group	Remarks
Government project	0.6013± 0.0487	B	Means with the same letter are not significantly different. $\alpha=0.05, df= (2,109)$
Self-motivated	0.7785± 0.0579	A	
Non Tree Planters	0.5776 ± 0.0444	B	
F	4.23		
P	0.0170		

Drawing a correlation between elephant destruction and the belief that trees were safe from elephants, the survey produced evidence (Figure 10) that 24% of tree planters under the government project, and 42% of self-motivated tree planters believed that trees were safe from elephants' disturbances. Only 4% tree planters under the partnership system and 6% of non-tree planters believed that trees were free from elephants' damage.

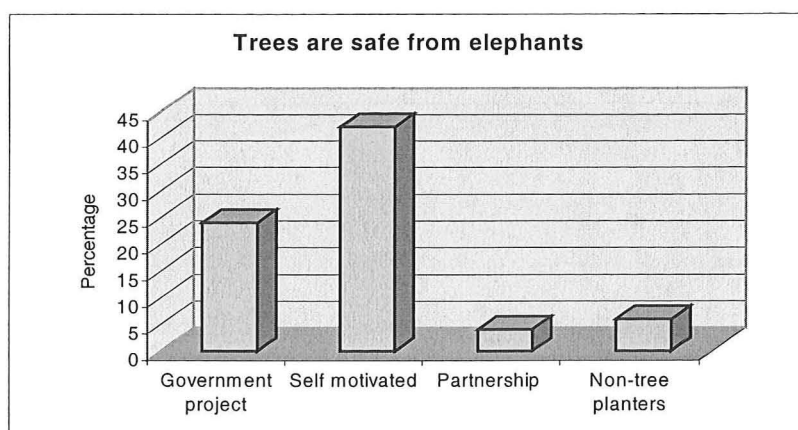


Figure 10: Landowners who believe trees are safe from elephants

Examining Table 16, Figures 9 and 10, the survey results support the argument in the decision tree model (HDM) that predicts that experience with elephant destruction affected landowners' decision to plant trees. Landowners recognised that trees were the only surviving products that could make their lands productive. The survey also produced two results that 34% of tree planters under government project admitted that, among other reasons indeed the elephant damage influenced their decision to plant trees. No single tree planter under the partnership said that their decision to plant trees was affected by elephant damage, while 39% of self-motivated tree planters confirmed that elephant damage was one among the factors that influenced their decision to grow timber trees.

The role of forestry extension workers

The extension workers usually live in the same village as the interviewees or at a nearby village. As part of their task, the extension workers conduct regular meetings at least three times a year with all members of the farmer group present. Through this meeting, the extension workers extend information on the availability of any government programme, and advise the members of the farmer group on how to get access to the provided facilities.

Most of the interviewees (104 out of 142 respondents) admitted that they knew about the advantages of trees because of the forestry extension workers. The 104 respondents were those who had idle lands, and mostly did not need more rubber on their lands.

The respondents generally were interested in the advantages of trees because of its advantages in giving a shorter period of return compared to rubber or oil palm. The following quotes are typical of their explanation of why they planted trees.

“Before I planted trees, the forestry extension workers used to come and visit our village. They advised me to plant sengon trees on spare land. They asked us, “How many years to get rubber trees ready to tap?” We answered, “Nine years”. They asked us, “How many years does oil palm take to fruit?” We answered, “11 years”. They said if I plant sengon trees, they could be harvested and sold for wood processing in within six –seven years. It is short compared with the maturing period of my rubber trees. I heard also that elephants would not disturb sengon trees”.

“I did not know who would buy my trees. The forestry extension workers assured me the wood processing companies would be the buyers. They also insisted that every one must need timber, especially in the coming years when we have less forest left. It is likely that timber has a bright future. So I decided to plant trees especially when they told me that I could get free seedlings”.

However, there were two respondents who claimed that the advice of forestry extension workers needed further proof, so they did not plant trees. Below is the typical answer of why they were not interested in planting trees.

“The forestry extension workers advised me to plant trees. According to them this will enable me to get a quicker return. But, I am not convinced of their story about trees, so I have not planted trees. I have spare land, but I still need more rubber trees for more income”.

Landowners inside and outside government project areas had been approached and advised by the forestry extension workers to plant trees. Some of them took the advice and planted trees, but some of them did not. Table 18 shows the number of respondents who were approached and were not, as well as the result of the number who planted trees and who did not.

Table 18: The Effect of Extension Workers in Landowners' Decision to Plant Trees

Location	Approached (104)				Not approached (37)			
	Plant		Do not Plant		Plant		Do not plant	
	n	%	n	%	n	%	n	%
Inside Project areas (23)	22	21	1	4		0		0
Outside Project areas (118)	56	54	25	21	5	14	32	86
T o t a l	78	75	26	25	5	14	32	86

Table 18 shows that among 104 landowners who were approached, 78 (75%) decided to plant trees, and 26 landowners (25%) decided not to plant trees. Among 37 landowners who were not approached only five (14%) planted trees, and 32 (86%) decided not to plant trees. The data show that landowners who were approached by the extension workers were more likely to plant trees $\{\chi^2 (df = 1, n = 141) = 42.6, p < 0.001\}$. The forestry extension workers appear to have played an important role in the decision-making. The HDM does not show that family (spouses) is one of factors that influence landowners' decision-making to plant trees. However, the survey data also show that along with the influence of extension workers, family (spouses) influence was considered important by the decision-makers. Sixty-nine percent of tree planters said that family (spouses) influenced their decision to plant trees.

Forestry extension workers approached and advised landowners to plant trees. However, the survey found that not all tree planters took their advice to plant trees. The survey showed that 97 % of tree planters under government project, 50% of self-motivated tree planters, and 30 % of non-tree planters said that the forestry extension workers had approached and advised them to plant trees. However, Figure 11 below shows that only 83% of tree planters under government project, and 46% of self- motivated tree planters said that, along with other reasons, the forestry extension workers' advice had motivated them to plant trees. Tree planters under the partnership system regarded company staff's advice as one of several factors influencing their decision to plant trees as 100 % said that. These results mean that the forestry and also the company extension workers had played an important role in influencing farmers' decision to plant trees.

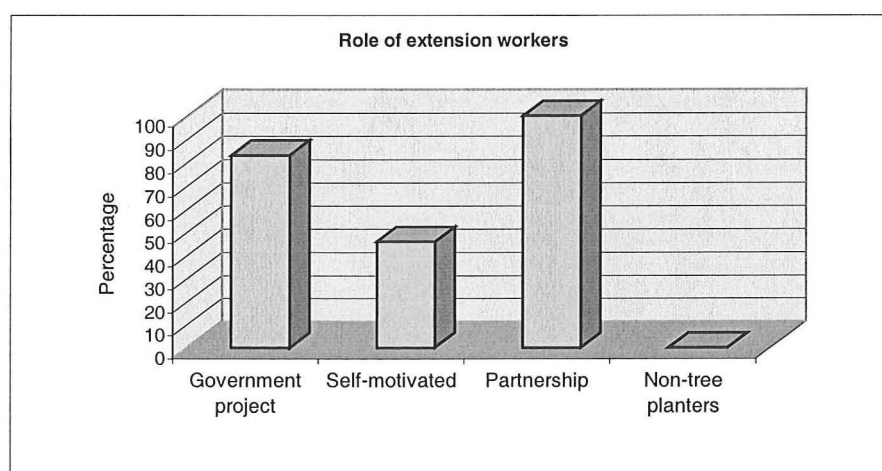


Figure 11: Percentages of landowners who said the extension workers influenced their decision to plant trees.

4.4.5 Location of land in the tree-planting project scheme.

The Kampar region had 11,349.75 hectares of tree planting government project areas, and 2,275 hectares of tree plantation under the partnership system. The previous section showed that the forestry extension workers were effective in promoting tree growing, especially in the government project areas. The decision tree model suggests that aside from the role of extension workers there were some other important reasons that influenced landowners' decision to grow trees in the tree planting project scheme such as project incentives and time availability. Below are typical explanations compiled from 14 interviewees during the first period of fieldwork.

"The forestry extension workers visited our village regularly in early 1995. The head of the farmer group had them meet with all the farmers in this village. They said planting timber trees was a desirable land use option. They had a proposal to use this village as a tree planting project. If we were interested, the project would provide us with the seeds, pay us to produce seedlings, clear our idle land, as well as plant the seedlings. The project would also give us some cash to buy food crop seeds. We accepted the deal because we have ample time after finishing work on our rubber trees from 7 to 9 in the morning. We were not too sure about the advantages of the trees. Some of us, especially the head of the farmer group, were convinced that trees are marketable, although others had some doubt. But, the promised incentives were lucrative."

"I actually needed a job. I had a hectare of uncultivated land. When the forestry extension workers offered to use my land as part of a timber tree-planting project, I quickly accepted. Working with the project enables me to have additional income. Besides, with the project incentives I have a chance to grow food crops".

Two interviewees had similar answers as to why they got involved with the government tree-planting project.

"We usually had nothing to do after coming back from tapping rubber trees. We used to spend our timer chatting at a warung (a traditional café) or just staying at home. It was just our luck to be able to get involved with the government project, so we have additional income from the incentive that they gave. The project gave us Rp.200,-(US 10 cent) for every seedling we germinated, and Rp.130,000 (US\$60) for planted the seedlings in the field".

The decision tree model also demonstrates that incentives and market guarantees were strong reasons why landowners got involved with the company tree-planting scheme (partnership system). The following two quotations are typical of the seven interviewees who lived in the area of the company tree-planting scheme.

“In 1994, representatives of Arara Abadi Ltd (a timber company) came to visit our villages. They said that the location of our village was suitable for the company tree-planting project. If we agreed to plant trees, they would provide us with anything we need from land clearing, seedling procurement, planting tree, and tree maintenance. They also offered incentives that include weed killers, fertiliser and food crops seeds. Further, the company will buy the timber harvested from our plantation. After deducting all expenses that they have to spend for us, the company will give the rest as profit to us. It sounds very good, so we do not have to worry about marketing our timber. There is no reason to reject their offer. Soon we do inter-cropping in the designated areas under company supervision.”

“I am a Javanese. I have been living in this transmigration settlement since 1982. I used to plant sengon when I lived on Java Island. I brought some sengon seeds, and planted them around my houses for shading and land boundary purposes. My neighbours did the same thing. There was no commercial reason. We know that sengon is marketable in Java, but we are unsure whether it is so in this island. Therefore, when representatives of the company came to visit my village at the end of 1995 to introduce the benefit of the sengon trees, I was not surprised. It was glad to get financial assistance to grow trees in order to supply the company's mill. I have experience from back home on how to grow sengon trees. I think the soil and the climatic condition of this region is suitable for sengon trees. But, the most interesting thing is that the company gave me weed killer, food crop seeds and fertiliser so I could grow healthy food crops for my family”.

The survey suggests that incentives were the main reason influencing landowner decision to plant trees. Figure 12 shows that 86% of tree planters under the government project and 94% of tree planters under the partnership system confirmed that they planted trees because they were interested in the promised incentives. The first group was promised cash incentives, such as planting, and tree maintaining wages. The second group was promised fertiliser, food crop seeds, and weed killer.

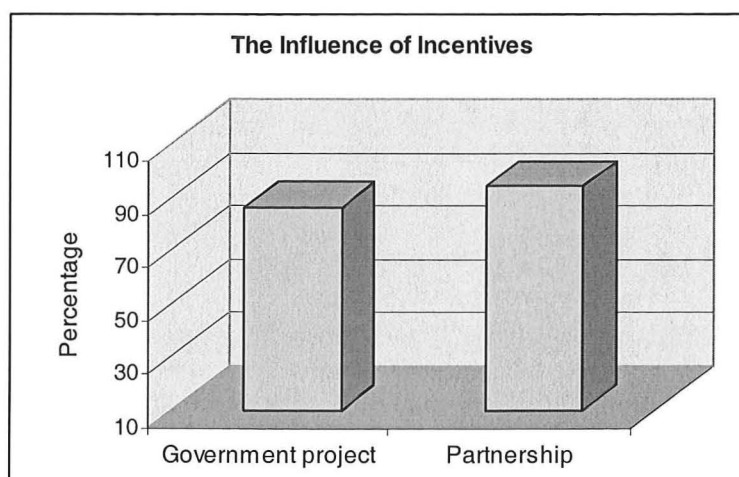


Figure 12: Percentages of tree planters who stated that incentives had influenced their decisions to plant trees.

During field observation in the first period of fieldwork, it was obvious that the government and the company through introducing incentives indeed had been successful in getting communities and individuals involved in the tree-planting project. Landowners planted trees because of the cash, weed killer, fertiliser, and seedlings. Those under the government project used the weed killer to clear and clean the lands, and fertilised the lands to be ready for tree seedlings and food crop seeds.

The survey results show that 91% of tree planters under the government project used this opportunity to grow food crops, and 66 % of them consumed the yield. However, 57% of tree planters under the government project said that they actually had not yet received the promised incentives although they had cleared the lands and planted tree seedlings and food crop seeds. They tended both the trees and the food crops. Within three to four months, the tree planters under the government project were able to harvest the food crops. The tree planters under the partnership system had not yet received the promised weed killer, food crop seeds, and fertiliser so only 25.86% reported they grew food crops (they consumed as well as sold the yields in the market).

The yields from the food crops represent the assumption that planting trees was able to meet local needs although the benefit was not directly from the trees. Fieldwork also showed that except for the ones close to the main roads, most of tree plantations had very poor growth due to lack of tending. Bribery may be involved in this scheme. Farmers with strategic locations were gaining more incentives in return for taking care of the trees intensively. The strategic or important locations meant that the lands were close to inspection roads where State Accountant

officials or important visitors were brought to look at the project performance. Heads of farmer group of course received more cash incentives since they were able to mobilise people.

Therefore, most landowners who had not yet received the promised incentives left the trees unattended. The following are two quotes that are a typical of the seven interviewees who expressed their disappointment over the broken promises.

"I have planted the trees. But, the company gave me weed killer and fertiliser only once instead of twice as they promised. So far I have not yet received my food crop seeds as the company representatives promised me a long time ago. Some of my friends have not received the weed killer and the fertiliser at all. Now I just leave my trees as they are".

"The forestry extension workers and some officials from the Forestry Regional Office in Pekanbaru promised to pay me for tree planting and tree maintaining, but it never happened. Some of my friends in this village also complain about our unpaid work to the head of the farmer group, but he said we have to wait and to be patient. So there is no point tending my trees".

The above information suggests that landowners inside the tree-planting project location may tend the trees when they still take advantage from growing food crops between the trees (*taungya system*), or the project paid the landowners to do so. They maintained the food crops free from weeds to get a healthy crop, and this system allowed the trees to grow well. But, when they had already harvested the food crops, the weeds grew back and competed with the trees, which had very poor growth.

Figure 13 show that only 38% of tree planters under government and 21% of tree planters under the partnership system tended their trees. These percentages are low compared with 73% of self-motivated tree planters who tended their trees without project involvement. There must be an interaction between the opportunities to use incentives i.e. growing food crops with tending the trees since the Chi-square test indicated significant difference in tending trees among the groups, $\{\chi^2 (df = 2, n = 204) = 49.67, p < 0.001\}$. Self-motivated tree planters had more motivation to look after their trees, as they did not rely on the incentives.

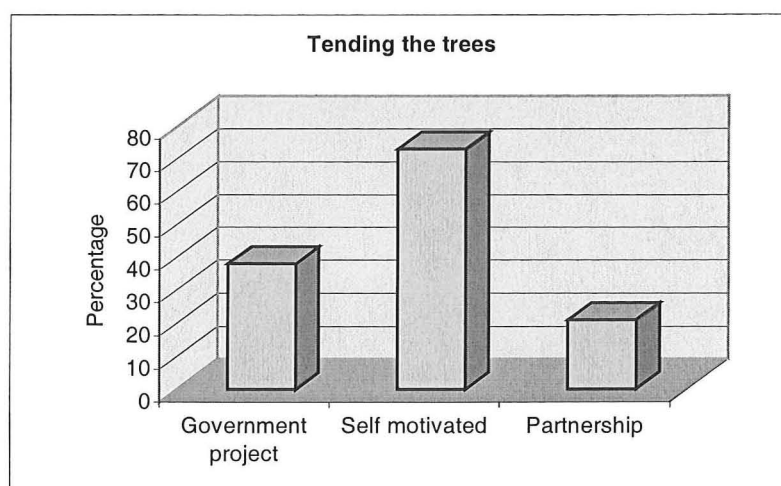


Figure 13: Percentages of tree planters who tended their trees

4.4.6 Time availability to participate in the tree-planting project scheme

Time availability was becoming important as a factor influencing landowner land-use decision-making in the Kampar region. The manufacturing industry development in this region had created more job opportunities that attracted more farmers to work as labourers. During the first period of fieldwork, 16 interviewees in the government tree-planting project areas said that they had spare time that they could use to plant trees. The two quotes below elaborate these points.

“I work as a labourer for a manufacturing company. Together with my friends who also got the same job, we are used to going off to work in the morning after we finish with tapping rubber trees. However, I still have time to get involved with the tree planting project by planting the seedlings on Sunday. Growing trees is not demanding, and it suits my time. I asked my family to grow food crops among the trees while we look after the trees. Within three months we could enjoy the first harvest. We sold the yield at the local market, and consumed the rest. The sale did not involve big cash, but it was income”.

“I had nothing to do after tapping my rubber trees. I used to have several casual jobs including cutting trees in the forest for timber, but now the good timber is getting harder and further away to find. So when the forestry extension workers offered me a tree-planting job, I accepted it straightaway”.

The survey shows that tree planters regarded growing trees as time-saving. Growing trees did not require much attention so they still could do their usual activities. The survey supports this statement with 73%, 93%, and 86% of tree planters under the government project, self-motivated, and those under the partnership system respectively who said growing trees is timesaving.

The first fieldwork observed that women and children were seen quite often planting food crops when the men were planting trees. Planting trees typically is a man's job. It means the availability of labour appears to be the factor that has most impact on tree-planting decisions. The out migration of young male farmers may be a constraint on the intensification of the existing land use practices throughout the region. As reported by the forestry extension workers, the project was stagnant especially during the seasonal peaks in demand for labour. It is understandable because some industry manufacturers offered better wages.

4.4.7 Size of project incentives compared to off-farm income

The first period of fieldwork showed that not all respondents who planted trees under the government project planted trees because they had time or were attracted immediately to the incentives. There were three landowners who did not have time for the project, and were not initially attracted by the incentives. However, after considering that the project incentives were worth more than their wages from working as casual labours, they later accepted the project's offer. Below are their typical explanations.

"My land is situated in the government tree-planting project area. I actually did not have time for the project, since during the daytime I have to go to the district to do labouring jobs. However, I considered that the money offered by the project was attractive. So I participated in sowing the seeds, putting the seedlings into plastic bags, and planting them in the field. I had the money and now I am back to my labouring job. With regard to the fate of the trees themselves, I hope the project can help me with more funding to tend the trees as well as to sell the timber".

"My four and half hectares of land is coincidentally situated in the tree-planting project scheme. I planted the two and half hectares with rubber trees, but some parts were idle. The forestry extension workers told me about the benefits of the project. I did not have time to get involved with the project because my business in the district is demanding. Like some others landowners, I allow one of my neighbours to tap my rubber trees, and we share the earnings, 60:40. The sixty is for the owner. I asked him to plant my two hectares of land with sengon and

acacia trees, and he could take the project money. I am pleased because my unproductive land is planted with trees. I look forward to seeing the first harvest and the prospect of my trees”.

The provision of incentives provided by the Riau Regional Forestry Office has concentrated so far on subsidising establishment costs, assuming that it was what the landowners needed. But, these did not seem necessary in order to motivate farmers to plant trees, especially for those who earn sufficient off-farm income. On the contrary, government subsidies may actually have a negative impact, for example, on the survival rate of the plantation as the previous paragraph has explained.

Nevertheless, the subsidies had attracted landowners who had difficulties finding suitable labouring jobs because of their age difference. Labour markets usually required younger people. The first fieldwork suggested that age must influence the decision to plant trees, although the respondents did not mention age as a decision factor motivating their action. The survey data reveals that there is a significant relation between planting group and the age group, $\{\chi^2 (df = 6, n = 309) = 28.63, p = 0.001\}$ as shown in Table 19 below.

Table 19. Age Class in Group of Tree Planters

Groups	Age group			Σ
	≤ 30 year old	$>30 \leq 50$ year old	>50 year old	
Government	6 (2%)	45 (14%)	13 (4%)	64 (20%)
Self motivated	2 (1%)	75 (24%)	5 (2%)	81 (27%)
Partnership	16 (5%)	35 (11%)	7 (2%)	58 (18%)
Non-tree	16 (5%)	78 (25%)	12 (3%)	106 (33%)
Total	40 (13%)	233 (75%)	37 (12%)	309 (100%)

Table 19 shows that tree planters under the government project in the over 50 years category have the largest percentage (4%) in its class. The research assumes that the older the age the less competitive a person is to obtain an off-farm job, which keeps him staying in the village so he has more spare time and tends to accept cash or other incentives to plant trees. Table 20 supports the above assumption by showing that the tree planters under the government project were significantly older than the other two communities $\{F (3,306) = 3.24, p = 0.0224\}$. Therefore, the results suggest that age is associated with farmers' motivation to stay in the village to grow trees.

Table 20: Age Comparison among Groups.

Groups	Mean Age		Remarks
Government project	42 ± 1.18	A	Means with different letter are significantly different. $\alpha=0.05$ df= (3, 306) n=309
Self-motivated	40 ± 0.74	AB	
Non Tree Planters	40 ± 0.85	AB	
Partnership system	37 ± 1.35	B	
F	3.24		
P	0.0224		

Farmers in the Kampar region typically aim their production at two markets: the market for agricultural commodities, the sale of which determines the household's revenues, and the market for factors of production (physical inputs as well as land, labour, and capital) which, in conjunction with revenue earned from the sale of agricultural commodities determines the household's level of income. Older farmers may feel less competitive in the production market, so they might feel more attracted to the incentives. Therefore, besides being more susceptible to the cash incentive they had more time to work on the farm compared to their more productive-age colleagues. This fact may have contributed to another finding as depicted in Figure 12 that 86% of tree planters under government projects were interested in the project incentives that included cash payment.

4.4.8 Solidarity and involvement in the tree planting scheme

By law every landowner in Riau province has to have a land certificate as legal evidence of ownership. If they do not, *ninik mamak* (head of tribe) could act as a witness to convince the government apparatus (such as the head of the village or the head of the district) that someone by family tie is the owner of a particular land although s/he is unable to produce written proof. Ninik mamak is an influential figure in a farmer group. Being a member of a farmer group means a farmer has to adhere to the decision made by the group, and *ninik mamak* has a strong influence in the process of the decision. The government is fully aware of the influence of *ninik mamak* in rural communities, and as a result quite often the government uses this influence to get villagers to participate in a government programme.

Three respondents in the first period of fieldwork confirmed that the prevailing farmer group system forced them to accept planting trees. The following quote illustrates how the process can influence decision making to plant trees.

“The forestry extension workers and the head of the farmer group informed us that we have to plant trees wherever possible in this village, because the tree is able to generate more income. The project will give me wages to plant trees. Actually, I was not convinced that growing trees is profitable. Who is going to buy our trees? Why do we not plant oil palm or plant more rubber trees, which clearly show that they are marketable? But, I can do nothing. I am a member of the farmer group that belongs to this village. The politicians said that I am supposed to become the government mediator or an agent of development. When the government introduces a project or a programme, it is my responsibility to stand at the front row. This is my land and I have every right to decide what is the best for my family and me. However, refusing tree planting may cause trouble. The other members might isolate me and later my access to information (technical assistance), credits, and other privileges could be denied. The worst is that the head of the farmer group may deny me access to my land. Everyone knows that the head of the farmer group is a ninik mamak or the chief of customary law. I have this land because of his role. Today ninik mamak is not as powerful as in the past. However, he can still be a legal witness of our land possession. Actually only few of us hold legal certificates of land tenure.”

“I really have no idea why I planted those trees, but I am a member of the farmer group here. I just did what other members did. The group gave me the right to this land because I am involved with the group. The project gave me five litres of weed killer, seedlings to plant, and some money. I am happy because I have an opportunity to plant food crops.”

Field observation showed that the project did not always pay some of the members of farmer groups who had planted trees. The project officials told the researcher that they had given the money to the heads of the farmer groups. But, when the researcher confronted the heads of the farmer groups they answered that the money was not sufficient to pay all members involved in the planting, and they were waiting for additional money as promised to them. Without sufficient money, they said that they would not pay any wages so as to avoid resentment among the members. As a result the trees under government projects were mostly untended.

The establishment of farmer groups was commonly associated with the ruling party, Golkar. The ruling party used to manipulate the farmer groups as their extensionists at the village level. The original idea was to improve communication and information among members; however, because financially these groups rely heavily on the government, quite often Golkar's politicians use them as a means to deliver their political message among farmers and villagers. A farmer group usually operates a set of arrangements regulating its facilities and functions and has the right to exclude others who do not have membership of the group. The following quote illustrates this.

“I grow trees on my land because I am a member of the farmer group. The farmer group is supposed to support any government programme or project. If I do not plant trees I may be accused of being anti-government programme. If so I will be in very big trouble. The head of the farmer group will not recommend my land to be certified.”

The survey supports the above sentiment by showing that 78% of tree planters under the government project said that they believed they would not get their land certified by the authority if they did not participate in the government project. This could be higher, considering that 87.5% of tree planters under the government project did not hold any land title, as the survey found. Further, the survey showed that 48 % of tree planters under government projects admitted that the head of the farmer group had influenced their decision to plant trees, while 12.5% of them said that their friends in the group affected their decision. However, the biggest influence came from the family since 76.5% of them agreed that their family suggestion had an effect on their decision to plant trees.

The research during the first period of fieldwork also interviewed landowners who were not the members of any farmer groups, but their lands were inside the government tree-planting project locations. Some of them rejected the project plan because of uncertainty about its future market. Below is a typical answer from landowners who had land in the government project area, but rejected trees.

“I am not a member of the farmer group, but I also received the offer to be included in the government tree-planting project. However, I am not too sure whether the trees are marketable, although I heard that sengon trees in Java are in good demand. Rumour said tree planting is wasting time because we can get timber easily from the forest, so I just stick with rubber trees. I recognise that trees are important for soil fertility, ecological functions, or environmental stability. But, to be honest I have other pressing needs to which I give higher priority. It is simply an economic factor. I consider planting oil palm has a more promising returns”.

Since those who rejected trees seemed neither to bother about the land title nor were interested in the wage incentive, it is likely that they were wealthy land owners or at least their income was higher than the average income of tree planters. Therefore, a *t* test was used to compare the monthly income of those who planted trees (Mean = Rp. 344,546, Standard Deviation = 58,379) and those who did not plant trees (Mean = Rp.375,896, Standard Deviation = 43,985) in the government project areas. The difference was not significant {*t* (103) = 1.465, *p* > 0.05, one-tailed}. The absentee tree owners who were included in the survey had a relatively higher monthly income than the non-absentee landowners that subsequently made up a significant increase in the average income of the tree planters.

4.4.9 Need something growing on the land

One of problems that commonly happened in the Kampar region was land encroachment. Squatters or landless farmers occupied lands and grew food crops to be able to survive. They targeted idle lands or non-cultivated lands where they assumed that the lands had no owners. When later the lands were found to be owned by someone else, in most cases the real owners had found it difficult to get them out from their properties although the owners have produced evidence of ownership. Receipt of purchase or even land title did not work in this case. Land cultivation and growing anything on their idle lands will protect the lands from squatters, especially if the landowners do not live close to the lands. During the first period of fieldwork 115 respondents out of 142 landowners mentioned that they felt secure if they had something growing on their lands.

The following quotes were collected from interviewees who regarded trees as a means to keep others off their properties. Trees were used to show others that their lands were under management. If there were other benefits associated with tree growing, the landowners would consider them as additional advantages.

"The presence of trees on my land is most important. They grow well and I do not have to spend much money on them. People are unlikely to use your land unlawfully when they see ongoing management on your land. I do not care whether trees are marketable or not. However, I believe, trees will be a profitable commodity. People will always need timber. You can see the houses around here, the richer the owners are the more wood they use to decorate their houses".

"I bought four hectares from the local people for investment purposes. It was very cheap. It was bare land and nothing grew on it except shrubs and scrub. I live in the city, so the villagers suggested that I should cultivate the land otherwise people might think it was no man's land, and they might use the land to grow food crops. If they are already in, it is hard to send them away, we, the legal owners have to pay them compensation for food crops they have already planted. I gathered information before deciding what is best for my land. The villagers said that sengon trees are easy to grow, the seedlings were easy to find, and we can sell the timber in six years time. So I asked someone to plant sengon trees. I paid all the costs, but it did not cost me a lot of money. Trees do not bother me with complicated cultivation of land. I will be happy if there are buyers for my trees. However, the important thing is I have no problem with squatters."

The secure feeling about land ownership should be related to the distance from the home of landowners to the property. The farther the distance from home, the less secure the landowners may feel about their possession. Therefore, although distance was unmentioned in the phase 1 fieldwork as an important decision factor, it is likely that it had an effect on landowner motivation to plant trees. Comparing the survey results on the distance analysis, on average the self-motivated tree planters significantly lived farther from their tree plantation than the other two tree-planter groups. The survey shows that there is a relationship between the distance from home to land and the groups of landowners $\{\chi^2 (df = 3, n = 309) = 22.85, p = 0.001\}$, and the self-motivated tree planters significantly had the farthest distance to travel from home to their land. However, it is not assumed that the farther the distance from home the more landowners incline to plant trees or the self-motivated tree planters are the group most affected by this motivation. There is no association between distance from home to the land and the number of landowners who planted and did not plant trees, $\{\chi^2 (df = 1, n = 309) = 1.76, p = 0.183\}$.

The first period fieldwork observed that self-motivated tree planters and absentee landowners had managed the trees well. The motivation to protect their property, their expectation of a good return, and having sufficient cash made their trees well-tended. Five absentee landowners were interviewed, and the following are typical explanations that emphasise the points.

"I have two hectares of land with a purchasing letter witnessed by the Head of the Village, and endorsed by the Head of District (SKT = Surat Keterangan Tanah). I am not too sure whether this SKT is adequate to settle dispute over my possession. The best thing I could do is plant the land with sengon trees. As my friends say this tree produces a good return within a relatively short time. Anyway, to my knowledge the trees will help me to show other people that this land has an owner".

"I have about seven hectares of land for investment purposes. I do not have time to visit the land regularly. When the caretaker of the land suggested that I should plant sengon trees because it is profitable, I did not think twice. At least I have something growing on my land. I heard several absentee landowners have complained to the village authority because the locals have used their land for growing food crops. Alas, the authority had difficulties asking the unlawful tenants to move off the property".

The above quotation demonstrates the attraction of trees to some absentee owners as a way to establish continuing rights to their idle land. The next quote is a typical answer from farmers who said trees suit their land-use objective, and avoiding land encroachment was one important reason that influenced their decision making.

“When I had to decide what I must plant on my idle land I faced some alternatives: rubber trees, sengon trees, oil palm, or fruit trees. I do not want to bother with food crops that probably demand more attention and extra care, and more over I can still afford to buy them in the market. I also have rubber trees, and I am busy with my job in the district. I have a son, but he works in Pekanbaru so I have no one to help me work regularly on my land. If I let the locals plant my idle land with food crops, I might find difficulties asking them to leave when I want to sell the land. Given the availability of my time to plant and to manage the trees, and the degree of attention that the trees probably need, I have chosen sengon trees”.

Survey results also showed that the sample acknowledged using trees to avoid encroachment. Figure 14 shows that 53 % of government project tree planters, 61% of self-motivated tree planters, 5% of partnership tree planters, and 60% of non-tree planters believed that growing something on their land could protect the lands from encroachment. There is a relationship between this belief and type of landowner, $\{\chi^2(df = 3, n = 309) = 54.88, p < 0.001\}$

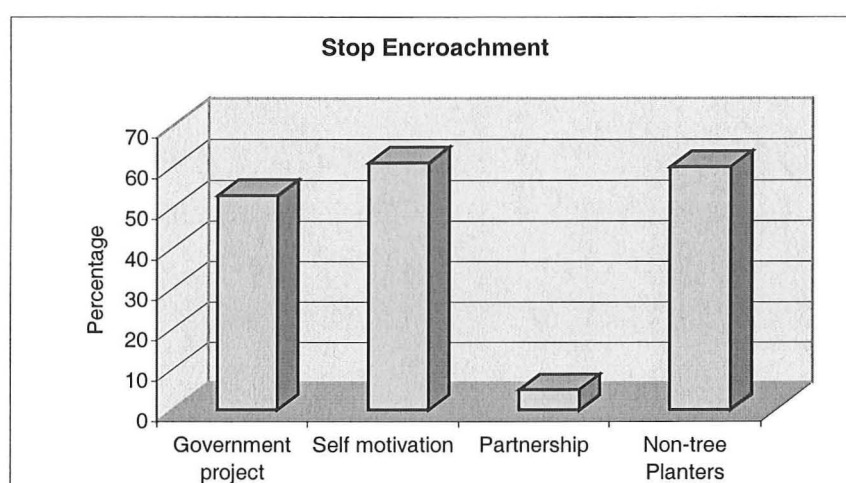


Figure 14: Percentages of landowners who believe that growing something on their lands enables them to protect their lands from illegal users.

If distance from home to the land causes landowners to have insecure feelings about their property because it is beyond their span of control, Figure 14 may be related to Tables 15 and 16. The self-motivated tree planter who said that among other reasons trees were a means to prevent encroachment has a relatively higher percentage than the three other groups. It is in line with the findings, which present the fact that self-motivated tree planters on average have significantly the farthest distance from home to their assets.

In the other hand, good relations and trust might create a secure feeling about the land, although the owners leave the land idle. Informants emphasised that land title is not useful if the people nearby do not recognise the owners, or they do not acknowledge him/her as the real owner. The absentee landowners may have a disadvantage by not being well-recognised by villagers who live near their investments, although it was not always the case. The following quotes are typical explanations from landowners who felt secure about their land, although they left the land idle.

“I leave the land idle. As a bus driver, I do not have time to work on my land. I do not worry with people who might want to use my land. I live close to the land and everyone in this village knows me as the owner. I do not bother renting the land to someone else, because I might find it difficult to terminate the agreement when I need the land for myself or when I want to sell it”.

“I run a warung (traditional coffee shop), so I do not have time to work on my land. I don't plant anything on it. But, I am very sure that nobody will use my land. I have been living here since I was born in this village. I feel comfortable leaving my three hectares of idle land. I will sell the land if I have a good offer. The land is not far, it takes half an hour to get there”.

“I bought the land a long time ago. It is only two hectares. I do not plant trees. I am renting the land to someone, and I feel secure about my land because it is cultivated. Besides, this person gives me half of the yield every time he harvests the food crops.”

Among those who believed that trees were suitable to be used to prove their rights there were different preferences for trees (Table 21). The largest percentage of tree planters under the government project (16.67 %) said they planted trees because trees require less capital and less time compared with growing oil palm or rubber trees. The largest percentage of self- motivated tree planters (23.33 %) said that the advantages of trees were less capital, less time, and less labour involved in tending. A Chi-square test shows there is no significant different in the opinion among groups, $\{\chi^2(df = 3, n = 90) = 1.121, p = 0.772\}$.

Table 21: Opinion on the Advantages of Trees planted to Prevent Land Encroachment

Group	Less capital and time	Less capital and labour	Less time and labour	Less capital, time & labour	Σ
Government	15 (17%)	6 (6%)	5 (5%)	12 (13%)	38 (40%)
Self motivated	17 (18%)	6 (6%)	8 (9%)	21 (23%)	52 (56%)
Partnership	-	-	3 (4%)	-	3 (4%)
Total	32 (35%)	12 (12%)	16 (18%)	33 (36%)	93 (100%)

4.4.10 Long-term cash return is preferable to short-term benefit

Interest in tree planting in the Kampar region can be associated with the lack of alternative sources of cash income. Below are typical explanations of interviewees who decided to plant trees because of their long-term economic value.

“I have planted my land with sengon trees using my own money. My neighbours recommended I plant those trees and people used to talk about the benefit of sengon trees. The cost of planting was not bad, the trees are growing and covering my land very well. I do not have to spend all my time looking after the trees, and I feel secure about my land now. I hope I will make a lot of money from these trees in six or seven years time”.

“I bought four hectares of land for investment purposes. There are a lot of options on what I could grow. It must represent investment too. It is likely trees suit my income strategy.”

“I have planted trees on my three and half hectares of land. I will earn a lot of money when I need it to meet the expenses of my son’s circumcision celebration. It will be embarrassing for my family if I cannot afford to have a big celebration to which all villagers will be invited.”

“When the forestry extension workers advise us of the advantages of trees, we thought it was the right idea. We are used to growing rubber trees so managing trees would not have to be much different. Growing food crops would just give us a short-term benefit so we do not think it would be worth much given the time and attention that we must spend.”

The survey results showed that 91% of tree planters under the government project, 87% self-motivated tree planters, and 100% of tree planters under the partnership system agreed that they cultivated the land to protect the land for investment purposes. By planting trees on the their land they were able to maintain their ownership until they sell the land or pass it on to their children. However, none of them said that they chose trees because they were aware that trees need a long period of time before they could enjoy the benefit from selling the timber. It suggests that landowners do not put investment values on anything that grows on the land but on the land itself.

The survey asked a further question with regard to their future plans, whether they still want to plant trees for the second rotation. Figure 15 shows that only 20.31% of tree planters under government project, 29.31% of those under the partnership system, and 33% of self-motivated tree planters still want to plant trees after the first harvest.

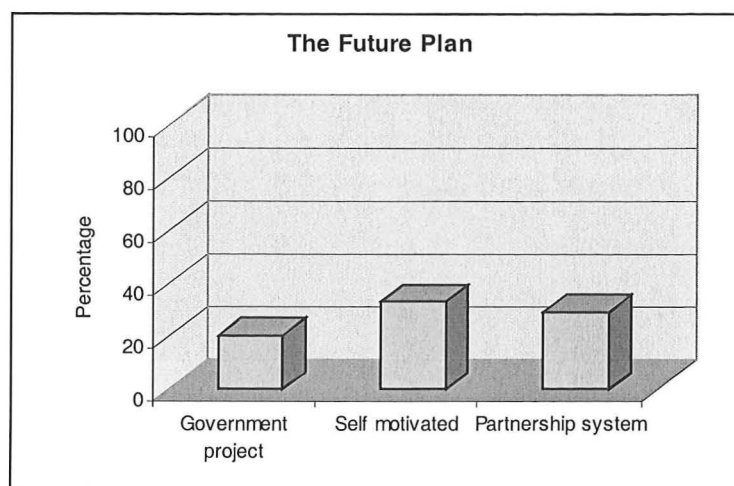


Figure 15: Tree planters who said they still want to plant trees after the first harvest.

The above figure suggests that landowners preferred timber trees because they thought the trees were able to give them benefits in a relatively shorter period of time than that of rubber trees or oil palm. However, when the tree planters realised that the market for their timber trees was still vague, they might change their trees to other commodities that they thought were able to generate immediate income. Below is a typical quote from a landowner who was still optimistic about the future tree market.

“The main reason to grow sengon trees is of course, that I believe that timber is marketable. I am convinced that everyone needs timber. Several years ago we witnessed the forestry companies leaving the so called lesser-known or, non-commercial tree species standing in their logging areas. Today however, they cut everything they can. I am pretty sure that sooner or later people would buy sengon either for pulp, or construction woods. I have heard that people are complaining about who is going to buy their sengon trees. They probably think that selling timber is similar to selling rubber resin, chip by chip. No one wants to buy two or four logs. But if they have more than 500 m³ of sengon timber to sell, I am sure, they will easily find the buyers”.

During the first fieldwork, it was observed that a busy market for timber extracted from community forests did not exist in Riau province. The reality was quite different from what was reported by the Riau Regional Forestry Office (Kanwil Kehutanan Riau) to the MoF headquarters in Jakarta. According to the report there were promising buyers for community-based timber production. However, the only big timber transaction happened in the Kampar region when the Director General of Reforestation and Land Rehabilitation came to Pasir Pangareyan village in July 1995 and officially opened the first harvest of community-based timbers with the presence of his counterpart, the Governor of Riau province. The event

involved some prominent forestry company representatives who were committed to buy the timbers in Pasir Pangareyan village and the neighbouring villages, which accounted for 200 hectares of tree plantation. Apparently, Javanese migrants first planted the tree in this area in 1982 for shading and boundary purposes). Kanwil Kehutanan Riau intended to use the event to show nationally that community forestry was developing in Riau, and that they needed more funding to support the development. The timber price was US \$20 - \$25 per m³ on the forest. Following this event, the Kanwil Kehutanan Riau reported a jump in the demand for sengon seedlings. Despite this interest in trees in 1995, landowners now were sceptical about the timber market. One opponent of trees expressed his concern about the market for trees. The explanation below is one example.

"I do not think sengon or acacia is suitable either for construction wood or furniture. The woods are too soft for that kind of purpose. The local market usually requires timber for construction. If there is no substantial demand for sengon timber, why should we plant sengon trees? We know that some forestry companies have bought timbers in Pasir Pangareyan village, but I observed that some of the purchased logs were left piled in the village non-transported. If they really need the timber, why they do not take the logs to their mills?"

During the second period of fieldwork, it was observed that the news about wood processing companies wanting to buy timber from private lands was no longer fascinating among farmers. There was only one company, which bought sengon trees, with diameters of 45 cm or more in the Kampar region, and this indicated to people that the market for sengon was still uncertain. There was frustration amongst the farmers about the future of sengon plantation. Some have even started cutting down and burning the young plantations to convert them to oil palm.

In extensive farming systems such as in Riau, farmers may tend to adopt new practices only where expected returns are much higher than inputs. The following quotation is a typical of the eleven interviewees who rejected trees.

"I do not plant trees because we will not get any profit from selling trees. Further, why do I bother about growing trees? Culturally timber is not needed to be produced. We can have it free from the forests whenever we need it. There is no point planting trees if the ultimate purpose is to produce timber. Who wants to buy sengon timber? The local sawmills do not even need it. Whoever plants trees, must have expected a good return from the timber sales. I hear that sengon has a good market in Java, but it does not in Riau. So, I have planted oil palm instead".

The survey found that the market is one of the important factors in the decision-making. Figure 16 shows that 65% of tree planters under the government project and 73% of self-motivated tree planters considered that market was the one reason that has driven their decision to plant trees. Tree planters under the partnership have a higher percentage (92 %) since the company (partner) has informed them that it guaranteed the market of the planted trees.

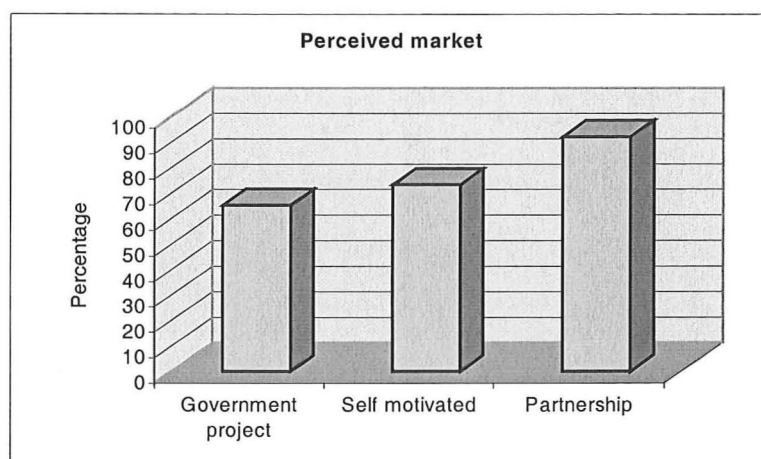


Figure 16: The percentages of tree planters who were motivated by perceived market

The survey results also found that the landowners who did not plant trees gave four main reasons for not planting (see Figure 17). Fifty-eight percent of non-tree planters said that trees do not have a market or are difficult to market, 25% said that trees have a long gestation period, 5% said that timber has a low return because of the low price and the high transport cost. The remaining 12% said they did not plant trees because they lacked inputs such as sufficient land, capital, and tending costs.

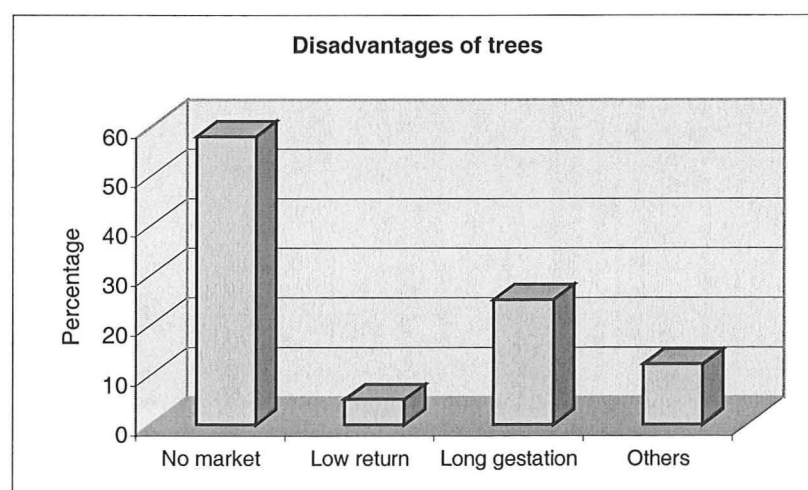


Figure 17: Disadvantages of trees according to non-tree planters

The first period of fieldwork observed that the Riau Regional Forestry Office, for the sake of protecting the state forests was developing a rather complicated system to obtain permits to harvest and to transport the timber out from the community forest areas. This policy might discourage people from planting trees since the procedure created additional harvesting costs. Two tree planters expressed their views over the complicated procedures to sell timber as follows:

"I am aware of the availability of a local market for timber, but it is not for sengon or acacia. Selling timber is not as easy as selling rubber resin or oil palm fruit. I heard that a forestry company may buy sengon timber from people, but selling timber at the offered price is profitless because farmers still have to deliver the timber to the mill. We have a problem with high transport costs due to low accessibility. We also have to pay a contribution fee for cutting and taking out our trees. Furthermore, to make matters worse there are "illegal fee gatherers" along the road from the forest to the mills".

"In my experience, I had to give some money to each of them to get my timber delivered to its destination. They did not even care whether I am only a poor farmer or a rich tradesman. "Wood is wood, and it is money", they said. I do not recall how much money I spent on this black practice. So far as I know, among several institutions in this region only Health Care Centre units or Schools do not ask for timber fees. I think it is the best decision not to grow trees on my land."

On the other hand, an interviewee who claimed that the procedure for selling timber was easy had another vision.

"There is no reason to be unable to sell trees. Those people are lazy. Riau people are accustomed to living on the rubber plantation, and are used to work with a short-term benefit. They just want products that they can sell anytime to get the cash anytime. Their life pattern suits rubber plantation. Growing trees means we have to get ready with a long-run investment. I grow trees because I believe that trees will be profitable."

Opinions differed over the procedure for selling trees. Table 22 shows that the tree planters under the government project and the self-motivated tree planters, 58 % and 60 % respectively, had no idea how to sell the timber at the time they decided to plant the trees. But 52 % of tree planters under the partnership system, with the guaranteed market from the company partner, believed that marketing their product was easy. The survey data show that difference was significant across the tree planter groups, $\{\chi^2(df = 4, n = 90) = 48.32, p = 0.001\}$.

Table 22: Tree-planters' opinion on timber-selling procedures

Group	Easy	Complicated	Don't know	Σ
Government project	7 (10.94%)	20 (31.25%)	37 (57.81%)	100%
Self motivated	6 (7.32%)	27 (32.93%)	49 (59.76%)	100%
Partnership system	30 (51.72%)	5 (8.62%)	23 (39.66%)	100%

The finding above suggests that except those who had tree plantations under the partnership system, tree planters knew very little about how to market their timber when it came to harvesting time. Those who knew how to sell timber believed that the procedure was complicated. The word complicated means the seller had to follow a complex procedure that consequently entailed unpredictable costs.

4.4.11 Trees give quickest return among long-term investments

One crucial reason why landowners planted trees was the economic consideration that trees were marketable products and compared to other commodities, such as rubber trees and oil palm, trees would deliver the quickest return. The following quotations are typical of tree planters who believed that trees would provide a quick return.

"I was excited when the forestry extension workers told me that I could harvest trees within only six years for pulp. It took nine or ten years before I could tap the rubber trees. I also heard that oil palm requires ten to eleven years to get the fruits ripe. So I planted sengon trees on my one and half hectares of idle land, and I hope what the extension worker said is true".

*" I heard that investing money in trees is promising. Some people have planted sungkai (*Fenomena canescen*) trees several years ago as a result of a community forestry program launched by Dinas Kehutanan Riau in 1992). But, a sungkai tree takes 25 years to mature, and I think it is an undesirable commodity to plant. So when people brought news that sengon trees could be harvested within six years, that requires less time than it takes rubber trees to mature, I planted sengon trees."*

"Despite the fact that the sungkai tree takes a longer time to harvest, it has a good market. I do not know for certain about the market for sengon trees. But, the forestry extension workers assured me that wood-processing companies would purchase my sengon timber within six or seven years. Last time some forestry companies bought sengon timbers they were harvested at Pasir Pangareyan Village. I could see that transaction has encouraged many landowners in this village to plant sengon trees".

“I used a simple calculation. If I grow a new rubber plantation I have to wait nine or ten years to tap, and I still have to wait for at least eleven years to earn money if I grow oil palm. So I just go for the shortest one. Growing trees is considerably cheaper since Kanwil Kehutanan has given me the seedlings for free. I will still have to buy rubber tree seedlings or oil palm seedlings if I want to grow them”.

The survey did not produce surprising results. When it comes to economic reasons 91% of tree planters under the government project and 100% of tree planters under the partnership system agreed that economic return was one among several important factors influencing their decision to plant trees.

4.4.12 Security of land ownership

The previous paragraphs show that landowners did not plant trees if they perceived uncertainties in economic return. Insecure property rights may dissuade farmers from undertaking tree investments since the procedure of selling timber from private lands requires landowners to produce appropriate evidence prior to applying for the harvesting permit. The researcher assumed initially that landowners would not plant trees if they cannot be sure to reap the benefits or if they lack legal aspects. This circumstance however, did not occur in the study area. People still planted trees even when they did not have secure property rights. A tree planter interviewee was representing his group to explain how insecure their lands were from other parties' possession.

“The land where I grow trees was idle. The land was part of the larger idle lands that can be found in this surrounding village. It had been idle for many years, and nobody has ever cultivated the land because we are aware that we have no right to use the lands. At the end of 1995 the forestry extension workers came to this village with the story of the benefit of trees. The villagers were eager to grow trees but we did not want to sacrifice our rubber plantation. We needed more lands. Some people came up with the idea of using the idle lands with expectation that the government will allow us to do so because the lands were absolutely unproductive, and we just wanted to support a government programme. I mobilised the villagers to clear the lands. I am given two hectares of land, and other people got land that might vary depending upon we have paid to the community contribution fund. We planted trees such as sengon, sungkai, and acacia. For the finishing touch we erected a board bearing our farmer group identification. Like others, I also grew food crops among the main trees. We used to weed the trees while we were looking after our food crops. We have several land claims. The claimants must be influential people or a powerful organisation, or at least they must have a

very good relation with the high-ranking government official. They claimed that they have legal rights to establish oil palm estate on our land. Two companies also claimed that the lands that we use are part of their concession areas granted by the Ministry of Forestry to establish a Hutan Tanaman Industri (Timber estate). We did not give up anyway, they could take the lands from us since we do not have any proof of being the legal owners, but they have to pay compensation for trees that we planted. Fortunately, they withdrew their plan. We are not sure whether it was because they will have to spend a lot of money on compensation or because they realised that we were carrying out a government programme. Now we are in the process of applying for usufruct rights from the authority. We do not want to own the land, what we need is to have the right to use the land"

The first period of fieldwork observed that land disputes between logging or estate companies against local people happened quite commonly in the Kampar region. As an example, there was an ongoing dispute over land compensation between local communities and RAPP (Riau Andalan Pulp and Paper) Ltd. that had turned into an open conflict. Over four-hundred families from three villages were demanding land compensation for their lands that had been taken by the company to establish an oil palm estate in 1993. The company insisted that the lands were actually part of their concession area, so they did not have to pay compensation. The local people were furious when RAPP Ltd. offered 'consolation payments' of a mere Rp.10 (US\$ 0.04 in March 1997) per square meter for the rights to use their land. Protests to the Indonesian Parliament and the National Commission for Human Rights in Jakarta brought recommendations, which were ignored by the company and local government officials.

In June 1997 RAPP Ltd. wanted to build an access road for their plant across the disputed land but the villagers of Delik set up barricades to prevent the company seizing their land. RAPP Ltd. responded by writing to the local police and administrator. The company pushed its road through. The army battalion was brought in to intimidate the protestors. Local people again blocked off an area along the line of an access road planned by RAPP Ltd. and demanded that compensation for their land rights should be paid in full. This time, the mobile police brigade attacked Delik village in the night. As villagers fled from the tear gas, they were shot, kicked and beaten, and many people were badly hurt. A protest by hundreds of people two days later was dispersed by two truckloads of the mobile police brigade and the community leader was arrested.

As reported by the Asian Development Bank (1996) and observed by the researcher in the field, current approaches to forest plantation development often led to conflicts between local communities' activities and the large-scale forest plantation establishment (HTI) that uses state forestlands. Under the prevailing TGHK (Tata Guna Hutan Kesepakatan - Forest Land Use by Consensus), local communities' activities inside the state forest are illegal. The practices of cultivation and woodcutting are classified as forest encroachment and illegal. Hence the policy suggested that the trespassers must be resettled outside of HTI areas although the local community claims that the areas are under adat (customary) laws, which are also recognised by the government. Mostly it is the local people who lose because they are unable to produce written evidence of their landholding. Another fact that this research found was that one of the reasons that motivated local people to grow trees was as a signal that their activities are under government consent that entitled them as legal users to force out HTI companies from the disputed lands.

The first period of fieldwork also observed that trees were becoming a symbol of the government itself. If people planted trees, it was because the Ministry of Forestry (MoF) wanted them to do so. Therefore, tree planters believed that they were supporting the MoF's efforts, and in return they thought that they deserved to be granted immunity by the government. They realised that the MoF is the most important authority in controlling forestland in this province. People viewed the planting scheme as a good opportunity to get access to lands without provoking the authority. The fieldwork observed that not only the poor farmers but also wealthy absentee landowners from Pekanbaru or Jakarta were using this opportunity. Below is a typical quotation of twelve tree planters who used the lands that they admitted were not owned by them.

"Before the forestry extension workers visited me, this land was idle for many years, and it was no man's land. At first I did not have any idea what I was supposed to do with this land. I planned to grow food crops there, but the land is not mine. Later I heard that the officials from Pekanbaru encouraged us not to let any land remain uncultivated in order to increase the regional productivity. Even President Soeharto himself said so on television. Planting trees is a government programme. I was committed to make this programme successful. I bought tree seedlings from Kanwil Kehutanan Riau, and along with food crops, I planted this land with trees".

The next paragraph is a quote from an interviewee in the first period of fieldwork, typical of three tree planters, which explains why this group had planted lands inside the state forest boundary that was clearly not privately owned land.

“It is ridiculous if the Kanwil Kehutanan Riau does not support our effort. Don't we carry out its important programme? We do what we are told to do. We grow tree species that the government recommends us to. So they should give us protection in return for what we have done for them. We do not want to own the land, we just want to have access to the land. When we feel we have to give up the land because someone or the authority takes the land from us, we will uproot and burn all the trees we have planted, and we will invite reporters to write that the forestry programme has failed in the Kampar region”.

In the second period of field work, the researcher went to the area mentioned above and found that it had no tree left, they had been replaced with other agricultural commodities such as ginger, garlic, onion, and oil palm.

Below is another statement from a landowner without a proper land title. This respondent planted trees as the customary law allowed him to use the land as long as he farms the land. He felt secure about the land although he did not hold any land title. If the land is not farmed the rights to it are ended and the land becomes available for redistribution.

“This land has been for a long time with my family. There is no written paper to prove my land ownership, but everyone here knows that I am the landowner as Ninik mamak (the head of tribe) grants me usufruct rights to use this land. There is no point in keeping a land certificate if the neighbours do not acknowledge that you are the owner. I grow trees because they are the cheapest to grow. Later when I find that these trees are not marketable, I might plant something else. So just wait and see”.

Landowners who did not have any land title have also found trees as a means to avoid conflict and claims from other parties who felt they had rights over the land concerned as well. The following is a typical quote from an interviewee who did not have land titles.

“I think this is the best way to get access to the land. I have no problem so far with land complaints. By planting trees people might think the government backs up my activities although being honest I feel insecure. With those trees I proved they work. I grow sengon trees along with other food crops. I know there are other more profitable land-use options than trees, but I just want to keep it this way.”

The survey tried to examine this issue by asking landowners how secure they felt over their land and whether they ever received any claim or complaint from other parties. This research assumed that insecure feelings or experiences with land claims from other parties would indicate that the landowners do not have legal rights over the lands. Table 23 below shows that

landowners under government projects reported the highest proportion (38.5%) with insecure feelings while the self-motivated tree planters had received the highest land claim (31%).

Table 23: The Secure Feeling about Land and Receive Claim

Group	Insecure feeling (%)	Receive claim (%)
Government project	38.5	28
Self motivated	28	31
Partnership system	10.35	12.06
Non-tree planters	11.33	10.37

Figure 18 shows that a similar pattern. The highest percentage of landowners who did not have land title were tree planters under government project (87.5%). The second highest were the self-motivated tree planters (40.18%). On the other hand, all tree planters under the partnership system (100%) had land certificates because of their status as immigrant, while 28.62% of the non-tree planters sample said that they did not have any land title.

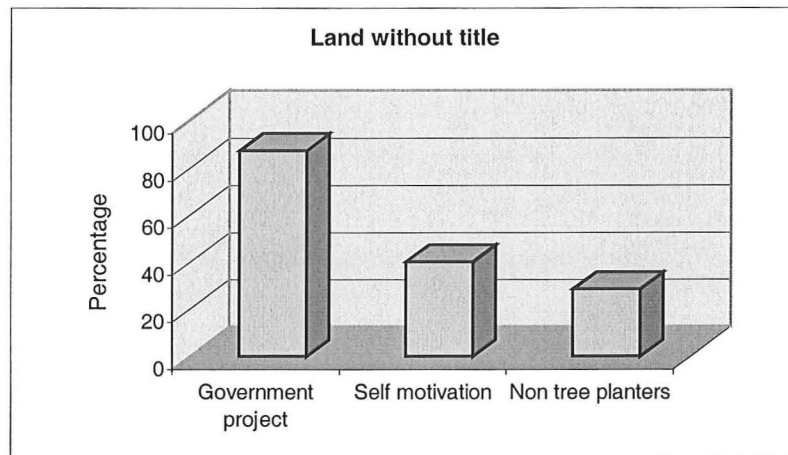


Figure 18: percentages of landowners without land title.

To draw a conclusion from Table 23 and Figure 18, and the result of Chi-square test, there is an association between an insecure feeling for not having the land title and the efforts to acquire the land through planting trees $\{\chi^2 (df = 2, n = 245) = 24.84, p < 0.001\}$. Many landowners without land titles, and who feel insecure about their property, planted the trees recommended by the government in an effort to secure usufruct rights. However, the important point is how secure farmers feel about their property rights with or without title. Often, even without an official title, landowners can have a secure feeling over their land.

4.4.13 Establishment cost of oil palm is beyond financial capability

Tree growing is an attractive land use option to those landowners in the Kampar region who have problems with capital, time and labour although poor infrastructure may make access to the wood market difficult. While many types of land use could be lucrative, for example oil palm, some farmers were excluded from these opportunities because they were unable to raise the required capital to invest and were unable to cover the high regular costs, which are necessary to get the highest return on their investment. The high costs derive from inputs such as fertiliser or herbicide to maintain the productivity of their land in the absence of trees. Although returns from alternative agricultural crops are greater than trees, it makes sense for these farmers to raise trees because they cannot afford the costs of producing alternative crops. Many respondents who did not plant trees agreed that oil palm was the most desirable commodity to plant although the price of the seedlings, and the establishment costs were considerably higher compared with those of rubber seedlings or other land commodities. Further, farmers had still to manage young oil palm intensively to guarantee its productivity and this means it involves more expenses.

The market for oil palm is very good indeed. When mature (11 years old), oil palm can be harvested twice in a month (one hectare of oil palm produces on average 600 kg every harvest). Therefore, if the market price is Rp.160 or more per Kg, the owner might reap at least Rp. 100,000 fortnightly or Rp. 200,000 per month per hectare. The middlemen or oil palm traders come regularly to the village to pick up the oil, weighing it for them and paying cash. The successful farmers with 2 ha of oil palm might earn Rp .400,000 to Rp. 700,000 per month. The oil palm has a record of 60 years productive period.

The total Riau oil palm plantation recorded in 1983 was 23,570 Ha. The Kampar Region had 16,400 ha in 1983. In 1995 the planting was 556,000 ha in Riau, with the Kampar Region sharing 129,592 ha. These numbers were estimated because that many private owners changed their land status and did not report it (Riau Statistics, 1995).

The disadvantages of cultivating oil palm, such as the need for intensive care that includes good seedlings procurement, might discourage poor landowners from managing this commodity. The high quality of the oil only lasts 48 hours after harvest. Therefore, the plantation areas should be close to the oil processing companies. A growing number of farmers planted oil palm without adequate information on its market, and knowledge of the quality of seedlings. It is feared that unselective seedlings might result in an unproductive plantation. Comprehensive research on the disadvantages of cultivating oil palm was urgently needed to change the

farmers' decision to do what the others do, planting oil palm. The study should include the market and demand prediction for oil palm.

Today landowners, however, allow their land to be used by the private oil palm processing companies. In return the companies promised high profits to the landowners. The landowners were recruited as members of the association. The companies, on behalf of the association, borrowed money from the banks at commercial interest, but the borrowers were still the landowners. The companies used the money to pay all the establishment costs, and they did all the financial management. The landowners will pay their credit when the plantations mature. Profit for the landowners will be obtained after deduction from revenue of the entire establishment and operational costs spent by the companies.

This scheme was out of the government control, but it has gained popularity among the landowners. The authorities feared that this practice might exploit the landowners. The landowners know nothing about all costs, and do not fully understand how to calculate profit. When something unexpected occurs, the companies will get away with the money, and the landowners might lose their lands because the bank only knows that they are the borrowers.

The statement below is a typical reason compiled from four respondents who were concerned with the high cost of growing oil palm, and they decided to plant timber trees.

"Farmers with limited income like me will have difficulty growing oil palm. Oil palm seedlings are expensive, and I still have to fertilise it to have a healthy growth. I know oil palm is a profitable land commodity. However, I need something growing on my land in order to prevent my land from being encroached so I plant something that I can afford to grow. It is sengon trees".

During the first period of fieldwork, it was rumoured that cheaper oil palm seedlings were available, and some oil palm growers purchased this kind of oil palm seedling. Two of the interviewees however, had rejected the idea of purchasing the cheap oil palm seedlings and planting trees instead. Below is a quote from one of the responses.

"I am aware that oil palm has a very good price and is easy to sell. The middlemen come to the village and buy the fruits with a very good price. Oil palm in Riau is booming right now. It attracts people to plant them. My friends told me to use cheap oil palm seedlings if I cannot afford to buy the quality seedlings. But, I was suspicious; I have heard that the cheap seedlings may be fruitless when they reach the maturity age at year nine. Fortunately, people in this region just do what others did, without proper understanding of the consequences of what they have done. Moreover, if everyone in this province grows oil palm, its market will be saturated,

and people will find nowhere to sell the fruits. Some people plant oil palm on their remote lands, far away from road access. So how can they sell the fruits if the oil quality rapidly deteriorates after 24 hours? Growing food crops promises me profit. But planting trees is more suitable for my time because it would take fewer risks, and I do not have to compromise my usual activities”.

However, 21 landowners (17 of them were from North Sumatra) who planted oil palm affirmed that they had no objection to the cost of growing oil palm. Below is their typical explanation as to why they planted this expensive land commodity.

“It is rational if I go for the option that gives me the highest economic return with the smallest inputs possible. Oil palm is an export commodity, so I am not worried about market saturation. The only problem is if someone or a company monopolises the purchase, as President Soeharto's youngest son did to clove trading in North Sulawesi, and also citrus trading in West Kalimantan. If they do that in this province, farmers would no longer enjoy the appropriate price, and we would suffer from the loss. I am pretty sure that oil palm is the most profitable use for land in Riau province, and a market will always be available for that. I purchased good quality oil palm seedlings, and I spent a lot on tending costs. I will enjoy my yearly profit after they reach maturity at year ten to eleven.”

The first period of fieldwork observed that those who grew oil palm were mostly Batak people. They were oil palm growers. They came from the North Sumatra province that has a long history of growing oil palm. This farming system proved to be the best strategy for their income generation. They operate intensive systems, so they value more marginal improvements, or higher input/output ratios. Besides, they normally had adequate resources to invest in their oil palm plantation. Below are their typical answers of why they grow oil palm in Kampar region.

“I come from North Sumatra, even until now I still live permanently in Medan (the Capital City of North Sumatra province). Along with the other Bataks who live here, planting oil palm is my life. I used to grow oil palm in my own region. My oil palm plantation in my home region is no longer productive, so it is the time to have it regenerated. Buying new land in Riau, and planting it with oil palm is much more cost-effective than renewing my old plantation. So I bought ten hectares of land here, and hire people from Java to plant and to look after my first oil palm plantation in Riau”.

“I am a Batak, I moved from North Sumatra last year. I sold my old oil palm plantation, and used the money to buy lands here. The land price here is cheaper than in North Sumatra. Now I start doing the old family business again. I am sure there will be no difficulty in marketing oil palm fruits. Normally the Batak community can afford to buy three to seven hectares per household in this region or even more”.

There were six respondents who planted oil palm, because they witnessed other people reaping benefits from oil palm. The following quote is one explanation.

“I see my neighbours start earning benefits from their mature oil palm. The middlemen come to our village each week to buy their newly harvested oil palm fruits. They do not have a big plantation, only two hectares per household, but they seem to be very happy with the present situation. Now I have a six- month- old oil palm plantation on my one and half hectares”.

Observation in the field affirmed that the government tree- planting project management was disappointed with the growing evidence that some farmers, especially high income farmers who previously committed to grow sengon trees, have converted their trees to oil palm. The subsistence farmers bought oil palm seedlings at a cheap price ignoring their quality. These farmers said that they take a risk using cheap oil palm seedlings, but it is better than the risk of being unable to sell their timber trees. This trend gave a slightly negative image to the government project achievement. Huge areas previously planted with trees for community forest projects were now found to be planted with oil palm. This circumstance forced the Riau Regional Forestry Office to modify its community forest long-term plan that consequently suffered a big loss from the seedlings investment and site preparation.

4.4.14 Household income

The previous section explained that oil palm establishment involved considerably high investment that consequently only wealthy landowners could afford. One indicator of wealth is income. Although the respondents did not explicitly mention income as a crucial factor in making land- use decision, the research hypothesised that the average income of oil palm growers was higher than that of tree growers. In the second period of fieldwork information was asked for about the respondents' monthly income. Table 24 shows that on average, the income of oil palm growers were significantly higher than that of tree planters. $\{t(df = 215, n = 217) = 1.97, p < 0.001\}$

Table 24: Income Comparison between Oil Palm Growers and Tree Planters

Group	Mean Income (Rupiah)	T grouping	Remark
1. Oil palm grower	Rp. 471,150	A	Means with different T grouping were not significantly different $\alpha = 0.05$, $df = 215$, $n = 217$
2. Tree planters	Rp. 374,630	B	

Further, the survey also examined whether the income of landowners might affect their decision to plant trees. The income comparison results in Table 25 below shows that the self-motivated tree planters and non-tree planters have a significantly higher average monthly income than those who planted trees under the government project or partnership system $\{t(df = 305, n = 309) = 1.96 p < 0.001\}$.

Table25: Income Comparison within Groups.

Group	Mean Income (Rupiah)	T grouping	Remark
Government project	Rp. 348,438.00	A	Means with the same letter are not significantly different $\alpha = 0.05$ $df = 306$ $n = 309$
Partnership system	Rp. 348,707.00	A	
Self motivated	Rp. 413,415.00	B	
Non-tree Planters	Rp. 423,585.00	B	

The survey results confirm the findings from the first period of fieldwork that suggested that only landowners who had adequate income could afford to grow oil palm. The income comparison analysis also support the assumption that tree planters under government projects and the partnership system were more susceptible to project incentives since their average monthly income was lower than that of self-motivated tree planters, who are understood to independently bear the costs of tree planting.

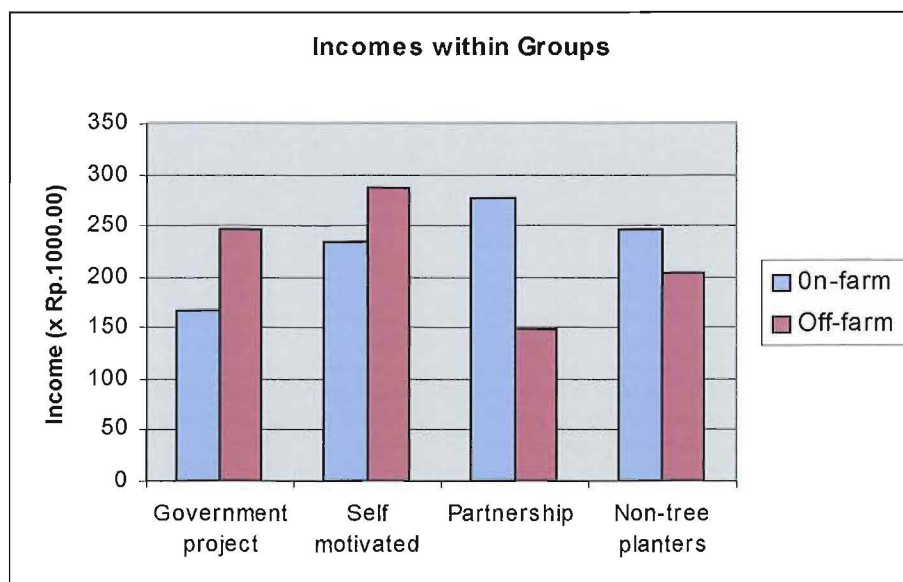
Further results in Table 26 below shows that landowners had two types of income, the income generated from their land or the on-farm income, and the income obtained from working away from their land or the off-farm income. Analysis of Variance (ANOVA) showed a significant difference at $\alpha = 0.01$ between the two sources of income within the groups of landowners. The tree planters under government projects and the self-motivated tree planters had higher monthly off-farm income compared to their on-farm income. However, the tree planters under partnership system and the non-tree planters had more on-farm monthly income than off-farm.

Table 26: Comparison of Different Sources of Income within Groups.

Group	Income		Significant difference
	Average on-farm	Average off-farm	
Government project	167.85 ± 8.98	245.96 ± 11.00	**
Self-motivated	233.93 ± 13.93	287.15 ± 14.06	**
Partnership system	276.85 ± 9.99	149.34 ± 12.66	**
Non-tree planters	245.83 ± 9.22	203.72 ± 12.79	**

Significance level: - none, * <0.05, ** <0.01

The ANOVA also shows that there is an interaction between monthly income and groups $\{F(3,1) = 20.48, p < 0.01\}$ although as a total, the on-farm income is not significantly different from the off-farm income $\{F(3,1) = 0, p > 0.05\}$.

**Figure 19: Different sources of incomes within groups of landowners**

If landholding size can be used as an indicator of wealth, the survey data on landholding size supports the findings that the self-motivated tree planters were on average wealthier than the other tree-planter groups. Table 27 below shows that the self-motivated tree planters had significantly larger farm size than the other two tree planter groups.

Table 27: Landholding Size among Groups

Groups	Landholding (Ha)	T group	Remarks
Government project	3.47 ± 0.133	B	Means with the same letter are not significantly different. $\alpha=0.05$ df= (3, 306)
Self-motivated	4.31 ± 0.115	A	
Partnership system	3.93 ± 0.102	B	
Non-tree planters	3.48 ± 0.127	B	
F	14.16		
P	0.0001		

The above results strongly suggest that landowners with high income have large landholding size, and on average the self-motivated tree planters, whose income was mostly supported by off-farm sources, had a higher income than the other groups of tree planters.

4.4.15 The land is situated inside the oil palm project scheme

The first period of fieldwork observed that oil palm investors organised landowners to grow oil palm for them. They gave loans to landowners to buy oil palm seedlings and for tending. They also guaranteed the market. Landowners would be given the profit later after the business partners deducted all expenses from the revenue. The oil palm investors took the land certificate as a bond. Below are typical statements from 12 landowners who let oil palm investors use their land.

“I did not bother with the initial cost. The project provided me with oil palm seedlings, and they pay me to plant and to maintain the plantation. I am pleased that the project is able to provide job opportunities that enabled us to earn more income. I also signed an agreement that let them keep my land certificate, sell the yield to them, and agreed that I would receive the profit only after the management deducted all expenses, and taxes from the revenue”.

It was rumoured that this scheme used the land certificates as bond to borrow some money from the banks. Therefore, if the oil plantation fails, the companies still can get away with the loan, while the landowners will never get the land certificates back, and even worse they might lose the rights over their lands. Three absentee landowners ignored the risk, but expressed the suitability of the scheme since they lived far from the land that they bought for investment purposes.

“My land is included in an oil palm plantation project. I just allow them to use my land to grow oil palm. I gave them the land certificate, signed the agreement, and let them to cultivate my land. That's all. If something bad happen, it is merely part of business. Every business takes a risk. I have no time to work on my land, I live in the city, far from where my land is situated”.

This scheme indeed helped landowners out with finances to grow oil palm. However, it is hard to foresee how farmers benefit from such a practice. Those who joined the scheme were promised regular income after ten years in return for giving up their rights to their own lands. The landowners still had to repay their debts in instalments from the revenue that was controlled by the companies. In good years they may make a reasonable income but, in general, local small holders have to face several decades of debt before they have paid off their original ‘investment’.

In the meantime landowners who had lands not included in the oil palm plantation project were happy to plant their land in a cheaper way, planting trees. The following is a typical response from respondents whose lands were not included in the oil palm plantation scheme.

“It would be nice to have land included in the oil palm planting scheme, so we do not have to bother with any high expenses incurred in growing oil palm. However, I need something to grow on my three hectares of land, and I have several reasons to do that. I am still pretty sure that sengon tree will be a profitable commodity in the near future. Moreover, I got free seedlings from nurseries established by the government project”.

This section corroborates the assumption that growing oil palm required substantial capital that not every landowner could afford. Planting trees was chosen as an alternative since this activity did not involve expensive establishment costs.

4.4.16 Free tree seedlings are available

The costs of establishing and maintaining trees are low, and lack of capital is unlikely to prevent a farmer from planting trees, although it may hinder him from obtaining a large number of seedlings. The government has established tree nurseries throughout the region, from which seedlings are usually available for free. The free seedlings policy in fact has motivated farmers to plant trees on their private lands. Four landowners gave the following typical explanation recollecting their decision to plant the trees.

“One reason I planted sengon trees was because I had access to the free seedlings, and I do not have any more expenses except for weeding. The forestry extension workers informed me about the benefit of sengon trees, and the seedlings would be provided if I was interested in growing them. People who are interested in growing trees came to Kanwil Kehutanan Riau. The village nurseries ran out of seedlings. Some of them did not even mind buying the seedlings. The news spreading that forestry companies bought sengon caused the demand for sengon seedlings to escalate. They were cheap to buy. Many people also made a good return from selling sengon seedlings.

“I am interested in planting sengon trees, because these trees suit my land condition, are cheap to establish, and they grow fast and only need a little care. When I had a chance to get free sengon seedlings, I planted them on my land”.

Below is an account by two interviewees who decided not to plant trees since they did not have access to free seedlings.

“I was willing to plant sengon trees, but there were no more free seedling left at Kanwil Kehutanan Riau so it was suggested that I pay for them, and the seedlings will be delivered to me. But, I did not want to spend any money on tree seedlings because tree growing is supposed to use less capital compared to other land-use options. I extended my rubber tree area instead. I am lucky, because I heard that people now have difficulties marketing the timber”.

The survey results show that growing trees did not require a high investment. Figure 20 shows that there was a significant difference between groups who said that planting trees require low capital $\{\chi^2 = (df=2, n=204) = 30.3, p<.05\}$. Ninety- three percent of self- motivated tree planters, and 81% of tree planters under the partnership system said that planting trees required low capital compared to 59% of tree planters under the government project.

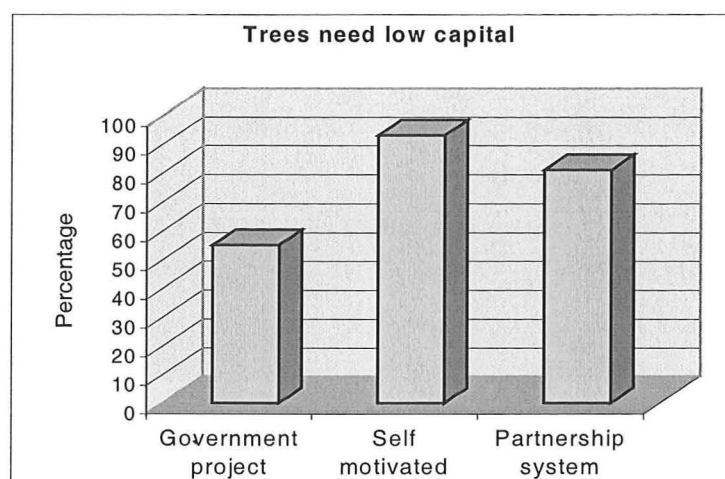


Figure 20: Percentages of landowners who view that planting trees requires low capital.

However, learning from the experience of other countries such as Thailand, India, and the Philippines, the Indonesia Ministry of Forestry believed that tree planters should get financial help especially in the establishment phase. To boost farmers' motivation to plant trees, the government introduced a soft loan scheme. The loan was provided to farmers who planted trees only. The soft loan had a very low interest rate at 7% per annum, while the interest rate in the market was 18% to 20% per annum in 1997.

The news about this scheme was spreading over the region during the period when the first phase of fieldwork was conducted. The following quotation is typical of five interviewees who heard about the soft loan.

"I do not have to spend a lot of money just to plant trees. I do not even find any difficulty in obtaining the seedlings. I could get them free, and plant them on my spare land. The government will introduce a credit scheme to give financial assistance to tree farmers. It is good news for us. But, growing trees does not require a high capital, so if possible I would like to request the government to allow the credit to be used to buy livestock".

The formulated HDM shows that landowners did not consider the soft loan as a factor that was important in influencing their decision to plant trees, so the survey asked their opinion on what they were going to do with the money if they received the promised loan. The survey results in Table 28 show that 80% of tree planters under the government project heard about the loan, but only 61% of those who heard about the loan would use the loan to tend the trees. Self-motivated tree planters heard about the loan, and 82% out of 80% who heard about the loan would use the loan to tend trees. Tree planters under the partnership system heard about the loan, and 83% out of 86% who heard about the loan will use the loan to tend trees. The survey also shows that 69% of non-tree planters heard about the soft loan.

Asking whether the soft loan could be used to attract people to plant trees, the results presented in Table 28 below shows that only 20% of self-motivated tree planters and 34% of non-tree planters said that the loan was useful for this purpose. However, there were high percentages of tree planters under the government project and the partnership system who suggested that the government should provide loans to attract landowners to plant trees. The difference among planting groups was significant $\{\chi^2 (df=3, n=309)=68.62, p<.05\}$.

Table 28. Opinion on Soft Loan for Tree Planting

Groups	Know about the Soft-Loan (%)	Will use the loan to maintain the trees (% of column 2)	Government should give loan to attract tree planters (%)
1	2	3	4
1. Government project	79.68	60.93	69.31
2. Self motivated	80.48	81.70	19.73
3. Partnership system	86.20	82.75	80.03
4. Non tree planters	68.86	-	33.90

The survey showed that not all tree planters heard about the soft loan, and not all tree planters who heard about the soft loan intended to use the loan for trees if they were eligible to get the soft loan. Some of them wanted to use the loan for something else. As suggested in the early sections, tree planters under government projects and the partnership system were motivated by project incentives. Interestingly, these two groups had higher percentages compared to the other groups who said the government should provide soft loans to attract landowners to grow trees.

4.4.17 Hiring someone to plant trees

It was found during the first period of fieldwork that 16 landowners said that one factor affecting their decision to plant trees was that they had or were able to pay someone else to do the job for them. These respondents were some of those who had reasons for planting trees that had been mentioned earlier. Below are quotations relating the importance of having someone to plant trees.

"I do not have time to work on my land, so I paid someone to do the job for me. I would rather plant trees because trees need less capital and are easy to plant and to maintain, and they grow well covering my land. I can also make a profit from selling the timber later".

“My land is located in a government tree-planting project. I did not plant the trees, but my neighbour did it for me. I gave them permission to plant trees on my idle land. I heard that the project paid them for the job”.

Two female landowners were interested in planting trees, but they did not. It was simply because they did not have anyone to plant the trees for them.

“It is good to have trees growing on my land, but I do not have time to plant trees, and I have no one to help me either, so I let the rubber trees grow and spread wildly on my land”.

“I have nearly two hectares of land, and other people are using my land to grow food crops based on a mutual agreement. I asked them to plant trees as well since we could get the tree seedlings for free distributed by Kanwil Kehutanan. But, they demand planting wages for the job so I rejected it. I do not have money to pay them”.

4.5 Conclusion

The results of this research show that landowners considered a number of decision criteria when deciding on a land-use option. With regard to tree planting, the results demonstrate that the combination of economic, demographic, social, political, and resource availability factors determined the outcome of how landowners in Kampar region decided to plant trees. As far as trees are concerned, it is clear that landowners had been involved in a complex decision-making process to suit their needs about trees at a particular time. The important point that emerges from the results is that the process of landowners' decision-making can be documented and analysed.

The research formulated the hierarchical decision tree model (HDM) of landowners' decision-making regarding tree planting in Kampar region in 1997. The formulated HDM consists of a combination of the decision process made by tree planters under government projects, self-motivated tree planters, tree planters under the partnership system and non-tree planters. It has two main pathways, a left-hand path and a right-hand path. Landowners going down the left-hand side of the model were involved in the tree-planting project scheme supervised by government or forestry companies. These landowners were motivated to plant trees by the combination of two reasons (spare time and project incentives) or influenced by farmer group solidarity. Landowners going down the right-hand side of the model are self-motivated tree planters.

Landowners would not plant trees if they had constraints on land or time. They would not plant trees either if they still needed more rubber trees or if the elephants did not destroy their rubber trees. The forestry extension workers played an important role in influencing landowners' decision-making to plant trees since they introduced the advantages of trees over other land commodities such as rubber trees or oil palm. However, the landowners inside government project areas were attracted to planting trees because of the project incentives. Those who were not attracted by project incentives still planted trees because they were members of farmers groups. As members of farmers groups, they had to show their solidarity by doing what the other members did. They were also concerned with social sanctions that might be imposed if they did not plant trees.

Tree planters under the partnership system were also interested in project incentives and were lured by the guaranteed timber market promised by the company partners, while self-motivated tree planters were not influenced by project incentives. The self-motivated tree planters had more decision criteria in their decision including securing land tenure, land investment, timber market opportunity, and quickest profit. These landowners neither cared about solidarity nor about social sanctions because they were not members of farmer groups, but they believed that trees were profitable. Therefore, besides economic factors as an important reason for them to plant trees, social factors such as preventing others from using their assets, avoiding claims, or gaining access to state forestlands were all reasons that have motivated them to plant trees.

Landowners might not plant trees as long as they could afford to establish oil palm plantation because they believed that oil palm was certainly more profitable than trees. However, those who could not afford to establish oil palm plantations may still not plant trees if their lands were located on the oil palm project scheme that provided them with access to loans. On the other hand, landowners who had lands not included in the oil palm project scheme would not automatically plant trees if they did not have access to free tree seedling because they did not want to spend money just to buy tree seedlings.

Model testing in 1999 achieved a reasonable level of accuracy of 82% although this is slightly lower than the level specified by Gladwin (1989).

The quantitative analysis supports and strengthens the understanding of each decision criterion in the HDM. The analysis also produces complementary findings that broaden our understanding of landowners' decision-making regarding tree planting in the study area. Tree planters under the government project on average were the oldest among the groups. The older the people the less involved they were in off-farm jobs, so they preferred to stay in the village and were more susceptible to project incentives.

The quantitative analysis also found the fact that supported by higher level of off-farm incomes and larger landholding size, the self-motivated tree planters on average were the wealthiest among the tree-planters groups. These tree planters did not need financial assistance to plant trees and had more capital to maintain their trees. They were different from the other two groups of tree planters, under government projects and under the partnership system, that had the highest numbers of landowners who suggested that the government should provide soft loans to attract more people to grow trees. The majority of self-motivated tree planters and tree planters under the government project said that the procedures were complicated and involved unforeseen costs that may hinder people's interest in growing trees. It is different from most of the tree planters under the partnership system who agreed that the procedure of selling timber was easy since the company partners promised to buy the trees from them.

CHAPTER 5: DISCUSSION AND CONCLUSION

5.1 Introduction

The main task of this final chapter is to discuss the results presented in Chapter 4 in order to advance our understanding of farmers' decision-making regarding tree planting, the objective of this research. This chapter also concludes and summaries the thesis in terms of the procedure and substance of the research. This chapter begins with a discussion of the results provided in Chapter 4. The second section outlines the theoretical, methodological, and empirical relevance of the findings. The third section shows how some concepts found in this thesis can be applied to government policy recommendation, and the closing section discusses the limitation of this research and briefly delineates some of the areas for future research. The general point of this chapter is to underline how this research contributes to understanding farmers' decision making about tree planting.

5.2 Analysis of Decision Criteria

This section discusses all the decision criteria as presented in the decision tree model. It starts with examining how the availability of idle land, time and labour influence the farmers' decision to plant trees. Then it shows how economic factors have played an important role in tree-planting decision-making. Precisely how these economic factors such as project incentives have met subsistence farmers' short-term needs is made explicit. Then this section examines how the social factors of solidarity, protection from squatters, establishing rights and gaining political benefits are also critical factors in decision-making. Finally, consideration is given to other factors that might motivate tree planting and constraints against tree growing.

5.2.1 Availability of idle land, time, and labour

Land, time, and labour availability were crucial for Kampar farmers in deciding to plant trees or not. Resource constraints were barriers to motivation in tree growing. Since they viewed trees as a commodity with uncertain prices, they planted trees on lands which in terms of location and accessibility were undesirable to be planted with something, as they believed, that had more promising returns, such as rubber trees, oil palm or food crops. Without adequate time, it is unlikely a subsistence landowner in Kampar region would plant trees. Yet those with less available time chose trees as requiring less time to maintain than oil palm or food crops. They

ended to use their time for doing something that was perceived as more productive, such as working in industrial areas.

Arnold and Dewees (1997); Khosla (1999); Shaikh (2000) agreed that farmers use idle land to plant trees. They argued that faced with shortages of labour and other inputs to agriculture (compost, fertiliser, etc.), farmers will abandon their poorer or more distant land or put it under less intensive use, in favour of concentrating the use of available inputs on the more favourable sites. As pressure on their time and labour increases, many farmers respond by reducing the intensity of the use of the land, or part of their land. When faced with the decision to plant trees, farmers would use their idle lands because they were faced with risks in the form of uncertainties. These uncertainties included inadequate market information, insufficient knowledge of the timber business, and a long gestation period for tree options. Arnold (1997) observed that farmers in central Nepal tended to concentrate tree planting on selected portions of their lands. His discussions with land-poor farmers have shown that they limited the numbers of trees to what they can tolerate close to their food crops because of competition. Scherr (1993) also had a similar view as tree farmers in Kenya. Some farmers were happy to use their idle lands to grow trees since they did not compete with their profitable rubber trees or food crops. Further Scherr (1997) recognised that since Kenyan households were not always able to optimally manage all farmlands, farmers often concentrated their resources on the best lands or best food-producing/income-earning options. Similarly, farmers in the Kampar region grow rubber trees and food crops on the desirable sites or close to their homes. They planted sengon, suren, or acacia trees on the sites not used to grow rubber trees or seasonal crops to reduce the risk if the trees fail to meet their expectation. Therefore, the findings in Kampar region underlined the other research findings about availability of time and idle land influencing farmers to plant trees.

The tendency of farmers in the Kampar region is to grow rubber trees. Rubber trees are part of the Riau way of life. Along with oil palm and coffee, rubber is the prime commodity in the Kampar region. The Kampar region has 569,923 hectares of plantations, and 26.04 percent of them were rubber plantations. Sixty-three percent of the working age Kampar population was working in the agricultural sector and 62.5 percent of them were tapping rubber (Kampar Statistics, 1998). The advantages of rubber trees to fulfil subsistence needs have long been proven. Rubber tree production is suitable for landowners' economic activities, and meets their weekly and monthly needs. If they still have spare land to cultivate, after considering the availability of their time and labour, they may seek another income opportunity, one of which was planting trees for timber production. The quantitative analysis confirmed the HDM's

finding that only a small percentage of farmers who planted trees said they needed to plant more rubber trees.

In contrast to rubber trees, growing trees for timber production is a new activity in Riau province, and it consequently has some important risk factors. The risk faced has principally to do with uncertainty about marketing of the tree products, which caused some farmers to reject tree-planting. The probable outcome of planting trees cannot be calculated very well compared to the probable outcomes for the rubber resin. Unfortunately, elephants destroyed some areas planted with rubber trees which forced farmers to abandon the land. When farmers joined the government tree planting projects, they planted the abandoned land with free sengon seedlings. Later the farmers realised that elephants would not eat sengon trees although the animals still roamed the farms. The forestry extension workers spread this news, which attracted more farmers who had problem with elephants to plant trees. The quantitative analysis shows that before planting trees, the self-motivated tree planters had experienced more elephant destruction compared to the other two tree-planter groups, government project and partnership system. The site locations of trees planted by the self-motivated tree planters on average were significantly farther from home than those of the other two groups. Learning from the results, this research presumes that the farther the food crops or rubber tree areas from the settlement areas, the more exposed they are to elephants due to the closer proximity to the elephant home ranges.

The discovery of the problem with elephants confirms the view that the farmers' decisions about tree growing are also influenced by consideration of the role of trees in meeting objectives other than income generation within their livelihood strategy. These can include the contribution of trees to the optimum use of available land, labour and capital (Arnold, 1997). Rather than leaving the lands unattended because of elephants, the landowners grew something that they considered suitable for their land, budget, and purpose. Therefore, tree growing in Kampar region is seen as a means of productively utilising land without needing high capital until the land is further subdivided and/or passed on to their children when they grow up, have their own families, and need land to support their households. This tradition reflects the traditional land tenure system of Riau people that is community-based. Land belongs to the community but is divided among the families who can pass it on by heritage. When the land is uncultivated, abandoned, or the customary user is absent, the land goes back to the community or to his next of kin. The land tenure system traditionally puts land management and usufruct in the hands of the traditional chiefs or the heads of tribes or *ninik-mamak*. Therefore, aside from project incentives such as cash, free seedlings, and weed killer that were provided to

attract farmers to plant trees, the advantages of sengon trees (which were free from elephant destruction) also became important factors that influenced farmers' decisions to plant trees.

5.2.2 Economic factors

With the assumption that tree planters usually need financial assistance to cope with any shortcoming in the phase of establishment, the Indonesia Ministry of Forestry (MoF) and several private companies provided incentives through community forestry projects with the expectation that the landowners would be interested in planting trees. The community forestry programme in Riau was realised due to the spare time that the villagers had after they finished tapping rubber trees. This programme was influenced by attitudes inherited from the previous greening (afforestation) and reforestation programme. This greening and reforestation programme has been implemented in Riau since 1982. It demonstrated a relation between master (government) and labourers (people), since the participants were paid and given other incentives to carry out an order, planting trees.

The above top-down approach proved to working well in getting people to plant trees but it does not guarantee long-term participation or that participating people would maintain the trees. The quantitative analysis confirmed the HDM's finding that high percentages of tree planters under the government project and the partnership system were attracted to plant trees because of the provided incentives that can be used to meet their immediate needs. It represents the assumption that trees are able to meet the farmers' economic needs although it is not from the tree itself but from activities associated with trees. The provision of incentives has concentrated so far on subsidising establishment costs. But these do not seem necessary in order to motivate farmers to plant trees, especially for those who earn sufficient off-farm income. On the contrary, project incentives may actually have a negative impact, for example, as observed in the field, most of the tree plantations under the government project, and under the partnership system were unattended, and the trees did not grow well owing to weeds. It was indirect evidence that the project should continue to shoulder the cost of maintenance. The Riau Regional Forestry Office was proposing a tree-tending budget to Jakarta when the first fieldwork was carried out. During the second fieldwork the forestry companies that financially supported landowners to manage trees were struggling always to supply the participants with money to get them involved. One company even had to deploy its own employees to undertake the maintenance of trees planted by local people. It is concluded that people stop planting or attending their trees when the project incentives stop, or when they perceive that planting trees will no longer give opportunities to receive the project's incentives.

The above finding supports Arnold et al. (1990) who argued that in Bihar, India, farmers appeared to be planting trees in response to the short-term returns from the cash payments provided by the project rather than longer-term returns from investment in trees. The finding is also prevalent amongst other projects such as in Asian countries (Shah, 1992; Hyman, 1993; Wiersum, 1997) and in Africa (Arnold and Dewees, 1997; Dewees and Saxena, 1997; Scherr, 1997) that use local participation to carry out tree-planting activities by giving incentives. Dewees and Saxena (1997) confirmed that the involvement would cease when the project stops the incentives.

This study did not examine how Kampar farmers administer their labour division although in the tree-planting project areas women and children were seen quite often planting food crops between the trees that had been planted by the men. Women seem to be mainly responsible for providing daily food in the households. So they may oppose men's decisions to grow trees because women would lose the chance to grow crops when the trees grow taller and bigger. Planting trees is more likely to be the men's job, but women might take over the job when they feel this activity would indirectly give access to food security. No record on the role of women in tree planting was reported by the forestry extension workers in Riau province, although a few of the tree owners were women. It is possible that a woman may influence the decision-making by the husband as the survey result confirmed that family views mostly influenced the respondents' decision to plant trees. Women may tend to need immediate cash income and food and reject trees. Women's responsibility to provide household foods outweigh the higher expected future income that could be earned by planting trees (Warner 1977 and Khan 2000). However, women might support the decision to plant trees in the Kampar region since there will be cash incentives involved as well as the chance to grow food crops through *taungya* or *tumpangsari* system.

The project incentives also most attracted older farmers and those with no working-age family members to plant trees. Tree planters under the government project have a higher percentage of 50-year-old farmers and above. This finding is in line with Chimbela et al. (1990); Nilsson (1995), and Scherr (1997) who argued that older farmers, whose children were grown and have lived somewhere else, might opt for lower-labour-demanding activities, such as growing trees. Being less involved in the labour market allowed them to stay in the villages and with fewer alternative income sources they were attracted to the project's incentives. The older farmers in the Kampar region might view the government tree-planting project as a suitable income generator. Farmers with family members of working ages were less interested in tree planting and they grew rubber trees instead, while those with limited income and no labour placed a higher value on alternative land-use, planting trees and getting the incentives. Scherr (1985)

said that it is possible to identify groups or households because of their similar responses to land-use options. Families with many children still at home may place emphasis on food security, as well as regular cash income to pay school fees and other school necessities, so they are less likely to grow trees. Farmers with more abundant labour resources can grow more labour-intensive/crops.

Still focusing on providing cash payments to offset tree establishment costs, the MoF introduced a soft loan for tree farmers in Riau province. It may be providing a wrong incentive to manage more trees. This research argues that as a crop that requires only low capital inputs, it is not true that tree growing costs constrain farmers who want to plant trees. Kampar farmers appreciated the soft loan, but it was not an actual criterion in their decision to plant trees. Farmers mentioned that the soft loan would be good to help them to maintain trees, and others said that they preferred to spend it for buying livestock. Hyman (1984); Blair and Olpadwala (1988) observed that with any loan scheme to help the poor, the well-off would benefit. Therefore, the community forestry loan scheme only benefited a small group of people either in Riau or in Jakarta since none of the tree farmers had received the soft loan.

Aside from the project incentives, the HDM also showed that tree planters were attracted to planting trees because of the wood market and the chance to have a relatively quick return. When confronted by the facts that large areas of tree-planting projects were left untended, the Riau Regional Forestry Office reported (1997) that lack of environmental awareness by local people to maintain the tree plantation hampered the community forestry project's achievement. This research argues against this report since tree planters did not take environmental measures into account as decision criteria to plant trees. A forestry programme that reflects government concern about soil erosion, developing state owned bare land and unproductive lands, and fertility decline might not be unacceptable on private land.

This above observation is supported by Poffenberger (1994) who studied programmes concerned with soil improvement through tree planting. He argued that farmers may recognise that soil fertility and ecological functions are important, but they have other pressing economic needs to which they give higher priority. In addition, Scherr (1997) and Foley and Barnard (1984) suggested that farmers might implement rehabilitation investment if land degradation threatened their productive resources. Foresters (as well as project planners) tend to think that they themselves know best ecologically and economically what is most needed in the way of forest products, so they should decide what local people must do. The local people, in this view, need only to be mobilised into action and given orders. Therefore, to have a successful community forestry programme, a wood market should be made available to meet tree farmers' expectation of economic return (Foley and Barnard, 1984; Blair, 1988; Dove, 1988; Hoskins,

1990; Arnold, 1997). However, as shown by the HDM, landowner decision-making regarding tree planting in the Kampar region was not influenced solely by economic factors since landowners also use non-economic measures in a combination of decision criteria in deciding to plant trees.

5.2.3 Social factors

The need for planting trees in Kampar region includes maintaining social relations and showing loyalty or solidarity among members in farmer groups. It was also to prevent others from using the land without the landowners' consent, or to avoid land claims and repossession by other parties and to legitimise farmers' access to use state forestland. All of these are social factors that influenced farmers and landowners' decision-making to plant trees, although as shown in the model, social values that explicitly enter into such decisions were conditioned by economic considerations too.

There can be an unpleasant feeling if a member does not do what the head of the farmers' group or other members have agreed upon. The farmers' groups were established to promote the production and welfare of every member in the group, by easy access to information and technology, training and facilities, subsidies and other supports provided by the government (Kanwil Kehutanan Riau, 1997). These benefits are privileges. Therefore, members feared exclusion from their rights as a member if they did not plant trees. Similarly they feared that their rejection of tree planting might ruin their group's image. It might cause the government to decline the group's access to the government supports and services. Without planting trees, members might fear being excluded from their groups. When former President Soeharto was still in power, the ruling Golkar party used to compel anyone who received government facilities to become a party member or its supporter. The establishment of farmer s'groups was associated with the influence of the ruling Golkar party (Down To Earth, 1999). A farmers' group usually operated a set of arrangements regulating its facilities and functions and had the right to exclude others who were not members of the group. By adhering to the group's plans or activities, members maintain access to land or government technical assistance and subsidies such as fertilisers and insecticides. This research observed that some farmers' groups also operated government-driven agricultural programmes on state-owned lands. These sorts of programmes enable subsistence farmers or those with limited resources to have access to land to survive. However, some landowners who did not care about solidarity or did not feel for the government facilities would be unlikely to plant trees.

The diminishing of Riau state forests due to logging and forest conversion to estate plantation has also tightened government control over what remains. Further, with the expansion of logging companies and estate crop companies, public access to forestland is increasingly restricted. Subsistence farmers use all opportunities to be able to grow food crops in order to survive. Their limited resources (especially land) force them to grow food crops illegally on government land or uncultivated privately owned land. This land use situation resulted in the opinion in Riau province that any form of land management will prevent squatters from using the lands.

Since the Riau Forestry Regional Office distributed free acacia and sengon seedlings to anyone who was interested in planting trees, some landowners outside tree-planting projects took advantage by planting their land with trees. Although some landowners had to buy the seedlings, they still considered that growing trees was the cheapest way to protect their investment. They did not care whether the trees were profitable or not as long as their land was cultivated, although they hoped that they would be able to sell the trees later. On the other hand, landowners who felt that it was unnecessary to protect their land from squatters would leave their land unplanted or planted with food crops that required extra time and costs to cultivate.

Tree planters who needed to plant trees to protect their land from squatters were self-motivated tree planters who were unable to directly control their property. That trees needed less time to maintain, needed less capital, grew well, and were marketable were the reasons the landowners had before they decided to grow trees to protect their land from squatters. These tree growers were mostly absentee landowners, and they represented the highest percentage of landowners who tended the trees. This situation is similar to a study carried out by Salam et al. (2000) in Bangladesh. They found that most of the tree planters were graduates, belonging to high castes and business castes. Most of them had non-agriculture occupation and they were mainly engaged in some business and other enterprise with a strong economic base. Knudsen and Madsen (1999) also observed similar things in Pakistan where mainly the absentee landlords mainly planted trees.

Another attraction of trees for some absentee landowners in the Kampar region was their suitability as an alternative to leasing the land out with the risk on losing control over it, or as a way to establish continuing rights to their idle land. Arnold (1997), Dewees and Saxena (1997), Gangopdhyaya and Mullick (1998), Scherr (1997), Warner (1997), observed that in Kenya and India tree growing was linked to control of the land. People planted trees to establish ownership rights prohibiting tenants or squatters from doing so. This thesis shows in detail that social factors are very important in influencing farmers' decision to plant trees.

Shepherd (1989), Saxena (1992) and Arnold (1997) argued that if farmers can examine the importance of economic factors versus the land tenure reason, economic factors are probably more important than land tenure in determining decisions about tree growing. This research argues against their view since planting trees in the Kampar region represented a degree of power that was crucially important to farmers. Tree planting could be associated with the power granted to implement a government program. The MoF was a powerful institution with the rights to control all the state forestlands throughout all provinces in Indonesia, including Riau province. Any company, individual or institution that needed to use state forestland had to obtain an approval from the MoF. Trees had become a symbol of or represented the MoF itself. If people grew sengon trees, it was because the MoF wanted them to do so. Therefore, in return they insisted that they deserved to be granted immunity to use the land, or at least they expected that the government would give them usufruct rights, as they did not have legal access to use the land. In Riau, customary land borrowing and lending arrangements are hereditary. After a number of generations, the tenure picture had become especially confused. Farmers also learned that land with sengon trees, beside being seen as a means of productively utilising land without high capital necessary until the land is passed on to their children, could be used to scare off third parties. The third parties were usually timber estate (HTI) or oil-palm estate companies, who claimed that they were the legal users of the lands which the farmers planted with trees. Those companies were reluctant to confront local people who were carrying out a government programme.

In recent times in Riau province the reduction in availability of forestland has nearly everywhere massively accelerated. Privatisation as well as government appropriation has been the main process taking resources out of common use. State assertion of control, first over the forest resource and then over the land has widely reduced access and rights of usage. The MoF held the control for the sake of forestry development and environmental protection. However, there was a widespread rumour that some corrupt government officials took this opportunity to arrange collusion with those who applied for rights to use the state forestlands for either forestry or non-forestry purposes. The rich and powerful were easily granted the rights to use the forestland in return for a large amount of cash as the illegal processing fee. Many poor Kampar farmers cunningly viewed this community forestry programme as a good opportunity to get access to land without provoking the authority. A similar case has also been found in Lombok and Sumbawa Islands, east Indonesian. Wiersum (1999) said that the farmers joined the *Leucaena*-based Farming System Project for ecological benefit, but also planted *Leucaena leucocephala* as a means to gain access to land or credit. In villages in which legal rights to land had not yet been fully established, the introduction of this programme created an opportunity to claim land legally and sometimes even to extend the farming area. The HDM

showed that landowners who did not have a problem with landownership would not feel it necessary to plant trees.

Learning from the poor, the rich in the Kampar region knew how to extend their farming area. Field observation found that a group of elite farmers in the Kampar region enjoyed access to lands by using trees as a symbol of government approval to use the state forestland. Some of them were opportunists who utilised good relations with government officials. Their ample resources (money, education, and lands) positioned them as innovators or new adapters of any forestry programme. But, some of them abused the privileges by illegally using the state forestlands for their own interest, gained control over it and grew any profitable land commodities. Similarly, Potter and Lee (1998) found indications that private companies and smallholders in West Kalimantan and Jambi provinces of Indonesia engaged in illegal tree planting, their tree crops encroaching on areas designated as protected forests or national parks.

The above sub-sections discuss economic and social factors that motivated landowners or farmers in the Kampar region to plant or not plant trees. This research also identified some additional factors other than the above reasons that were important to understand their decision-making regarding tree planting as discussed in the next sub-section.

5.2.4 Other factors that might motivate farmers to plant trees

Three land use phases have occurred in Riau province. These land use periods strongly affected the way that Riau farmers perceived the function of trees in response to their land use strategy to meet their needs. It was a kind of evolutionary process. In the first phase, the farming system or land cultivation in Riau was oriented only toward subsistence production. Farmers gathered fuelwood, building wood, medicine, and food from naturally growing trees. Shifting cultivation was the common agriculture practice in Riau. However, with increased population, shortened fallow period and permanent settlement, this long established farming culture gradually declined. Limited access to lands, further location from home, shortened fallow period, cultural change in terms of co-operation within the community, difficulties in obtaining a good variety of crop's seeds, wild boar and elephant disturbance, all were factors believed to be discouraging people from using this traditional practice. Consequently for the second phase, farmers established permanent farms, especially rubber plantations, and homestead boundary hedges. A third phase, as shown from experiences in Nepal (Campbell et al. 1987; Tamang, 1990; Gilmore, 1997), India (Poffenberger, 1995; Dewees, 1997; Lise, 2000), and Java (Hardjanto and Kuswanto, 1995; Simon, 1995) has yet to be established in Riau. But if and when a third phase comes, forest exploitation, deforestation due to estate plantation development and

increased population it will sharply reduce tree resources that consequently cause higher demand for wood products. Building-quality woods will become scarce in Riau province, and wood prices will escalate. In response, farmers will begin to domesticate local tree species and to adopt exotic timber species. Landowners will be not only interested in interstitial tree planting, i.e., planting trees around homesteads, or along pathways or borders, but they will also grow and manage tree plantations on part of their farms for commercial purposes.

Field research results in this thesis showed that some farmers have seen wood supply problems as natural forest depletion continues. Accordingly, Gilmour's (1997) assumption might be sound: in areas particularly where natural forest cover remains quite high such as in Riau province, farm forestry or growing trees for timber and pulp still fails to catch the imagination of most landholders. Field observation and discussion with farmers in the study area revealed that they were more familiar with fruit trees, which were planted around their home garden. Some landowners had indeed raised their concern over the decline of forest resources that forced logging companies to cut trees that previously were known less as commercial timbers although they found that the trend had not yet affected the local demand.

This research found that self-motivated tree planters groups had a significantly higher percentage of people who finished high school compared to other groups of tree planters and non-tree planters. It is likely that they had more chance to get better off-farm jobs and earn higher incomes compared to those with lower education. Sufficient off-farm income may motivate landowners to opt for planting trees because it suits their land-use strategy. Trees are easy to grow, are less time-consuming to maintain, prevent others from using their lands, and are perceived as profitable. In addition, education enables this group of landowners to foresee why Riau timber industries need to purchase timber from private land as the natural forest is continuously depleted. It is similar to Pichon's (1997) findings that in the north eastern Amazon provinces of Napo and Sucumbios, Ecuador, different educational levels do not directly influence peoples decisions to plant trees, but do have significant implications for people's perceptions toward deforestation.

Another additional factor is the firewood market. This research showed that farmers in the Kampar region value trees for timber and firewood. However, today Riau people would not plant trees only for the purpose of firewood. Since the natural forest in Riau was still large and able to supply a great part of the local people's needs, the price of firewood may be considered very low. Accordingly, there has been weak motivation in growing trees for this purpose, although the soil and climate were favourable for sengon or acacia trees. The exception was in transmigration settlement areas, where women and children were seen collecting firewood from sengon trees. It was not clear yet whether 'sengon firewood gathering' is their habit brought

from Java or because the forests in Riau were getting far from the residential areas, or they had time and ample family members to do so.

Collecting wood from the forests nearby for firewood has proved to be worthwhile to create additional household income. From the interviews, a person on average can collect 5.5 m³ per month or Rp. 500,000 (US\$ 250 in 1997) if it is turned into cash. Collecting other NTFP (Non Timber Forest Products) such as rattan, resin *damar*, *kemenyan*, *jelutung* gum, and honeybee, and also some fruits such as *durio*, *petai*, *jengkol* and *manggis* were regarded as additional income. These NTFP are usually 60 percent for sale and 40 percent are kept for family consumption.

As highlighted by Arnold (1995) and Warner (1997), trees are seldom planted to counter diminishing supplies of firewood, because this is a low-value commodity and lower cost alternatives can usually be found. Similarly, Foley and Barnard (1984) said that in many African areas efforts to commercialise fuelwood failed, principally because fuelwood is commercially feasible only when it can be gathered as a free good to be sold.

The hierarchical decision tree model (HDM) does not show that establishment cost and tree planting technique were constraints to tree growing in Kampar region. This finding differs from the government policy, which argued that the soft-loan scheme would encourage timber companies to set up tree management partnership with local farmers that directly also encourages the farmers to plant trees. The timber companies acting as guarantor or sponsor could use the loan to assist the farmers with establishing and introducing appropriate forest management techniques, as well as providing a secure market when the time comes to harvest the trees (Community Forest Soft Loan Scheme Manual, 1997). The loan money will be deposited to the company's account, and it will be directed to the members based on the progress made by farmers. The fund is channelled to the company account, but the responsibility to pay the money back is still in the hands of the farmers. This windfall gives the companies the chance of keeping and using the money for any purpose including non-forestry activities. The system is obviously benefiting the Company, but not the farmers. Who will decide the timber price so the tree farmers will be able to make a reasonable profit? Do the farmers have power to decide the timber price? The experience shows that even the MoF does not have power to regulate the wood price.

Tree farming involves a long gestation period, and the farmers have to depend on other sources of income. A soft-loan would be suitable to support them with their daily needs if the government allows them to use the soft loan directly. It is noteworthy to learn from three Indian forestry programmes as described by Blair and Olpadwala (1988); Chambers et al.(1989), and Gadgil (1989). They argue that government forests, community forests, and farm forestry are programmes that lead to benefits for the wealthy. They further argue that while programmes must provide the poor with benefits, they must also provide some degree of benefit for the wealthy. The Indonesian community forestry soft loan is just another example of Abraham's (1973) argument that as long as society is divided into classes, the predominant class with the power and wealth concentrated in its hands will benefit. Without careful planning, the state may represent the exploiting class. It is nothing more than an instrument to rubber-stamp, and provide an outward show of legal justification to, the decisions of that class. There was also observed in the field that elite groups were involved in Riau community forestry programmes in order to get access to state forestland as well as to the soft loan. This circumstance confirms Foley and Barnard's (1984) and Rao (1992) opinion that under the appropriate conditions, community forestry has proved itself to be an effective means of providing substantial individual and communal benefits. But it is also evident that it is an approach that is far from easy. Some programmes have failed completely, others have had unexpected results and sometimes undesired side effects.

The community forestry in Riau is still in the phase of establishment. There have been some transactions but still relatively small because of the limitation of its market. In terms of financial gain, community forestry means nothing compared to the business of timber harvested from natural forests. It has not been able yet to offer commission fees that usually occur as a result of interaction between foresters and their clients in Indonesia. Indeed, there are some institutions in Riau that are directly involved with community forests development. However, there are several indications that those who are involved in project management are more interested in the project fund than in how to manage a sound forest plantation. Further, the soft loan scheme issue was more attractive for wealthy timber companies, politicians, government officials and foresters rather than being used to develop Riau community-based forest management in more appropriate ways. Interviews with some high ranking forestry officials concluded that community forestry is not a desirable area in which to work since most of the Riau foresters preferred to deal with the financially powerful logging companies or concession holders. It appeared that foresters were reluctant to work with the poor because of the lack of incentive that the poor can provide (Blair and Olpadwala, 1988; Peluso, 1992).

Surprisingly, the model did not suggest that the cultural background of Kampar farmers influenced their attitude toward trees. Daswanto and Thalib (1995) argued that managing trees had been long recognised by Riau people because of their cultural proximity to trees. They said that the social system of some tribes in Riau province regulates how people harvest and plant trees. Therefore, if Kampar farmers did not use cultural factor as decision criterion to plant trees, it can be postulated that because they dealt with exotic tree species they did not regard acacia or sengon as part of their cultural system. Another possibility, as Warner (1997) argued, is that the cultural value that people put on a tree has been diminishing due to social and economic pressure. Finally, constraints against tree planting that may discourage Kampar farmers from planting trees are examined.

5.2.5 Constraints against tree growing

The main task of this sub-section is to discuss the constraints against tree planting as identified by the HDM. Landowners did not plant trees because they believed that there was no market for sengon or acacia in Riau province. Finding that only a small percentage of landowners intended to plant trees again after their first harvest supports this argument.

The only big community forestry timber transaction in Riau was in July 1995. The Director General of Reforestation and Land Rehabilitation officially opened the sengon first harvest programme in the presence of his counterpart, the Governor of Riau. The event involved some prominent forestry companies who were committed to buy timber harvested from private lands in Pasir Pangareyan village and its neighbourhood. The location accounted for 200 hectares, and Javanese migrants who planted sengon trees in 1982 for shading purpose in their home-gardens. The event was intended first to show nationally that community forestry was developing in Riau, and second to convince the local people (participators) that community forest was a profitable business with good market availability. The timber was priced at US \$20 to \$25 per m³ in the forest. This ceremonial event successfully lured landowners to plant sengon trees. The Riau Regional Forestry Office's reports indicated that high demand for sengon seedlings was recorded through the end of 1995. The reality in the field was different from what was reported to Jakarta. The event, however, won more funding for community forestry projects in Riau. Today the news about wood processing companies who want to buy sengon timber is no longer lucrative. The reality told people that the market for planted trees was still uncertain. Some have even started cutting down the young plantations for oil palm or other land commodities.

One factor that caused a lack of success of tree planting among landowners in Kampar region was because the MoF directed it to respond to the perceived wood supply problem, rather than as a response to local needs for tree products. Murray (1983), Arnold (1987) and Hoskins (1990) argued that farmers simply reject trees without a market available. This research did not obtain evidence that local people used sengon or acacia poles and timber for construction except Javanese migrants' children who collected firewood from sengon trees. Observation proved that there is not much incentive to plant trees because the required building materials, poles, and firewood can be obtained from existing resources. Learning from agroforestry projects in Cabo Delgado Mozambique, Nilsson (1995) said that the motivation for growing trees is high in densely populated open land areas where access to forest products is strongly limited. In areas with more forests, the motivation for growing trees is often extremely low. This thesis observed that the MoF's (1995) priority in promoting tree growing is to create new wood stocks to reduce pressure on remaining forests. The results of this research suggest that tree planting programme should be directed to meet the tree planters' needs, not to support the government's priorities which farmers often find hard to understand. This position is supported by Katere et al. (1999), and Wiersum (1999) who argued that to guarantee the success of tree planting projects, the trees should meet one of the following community objectives: direct household needs, inputs into agriculture and livestock production processes, cultural or religious values, and sources of income or employment.

Farmers were also concerned with permits for harvesting and transporting timber in Riau province, and these concerns constrained tree growing. The applicants bear the expenses although a state budget has been provided for the purpose. Blair and Olpadwala (1988); and Ligon and Norain (1999) agreed that forest legislation tends to protect well-established political and commercial interests, and the interests of those entrusted with enforcement and who are able to extract bribes in exchange for the production of the required harvesting transport permits. Because of the need for transport permits, tree farmers would be less inclined to make arrangements for sale and marketing the timber themselves, and they will rely heavily on village agents to whom standing trees are sold, and who organise the transport. Pre-harvest sale is likely to be arranged by village agents because farmers are unwilling to assume the risk and cost of arranging transport permits themselves. Agents and informants both reported that, even if they held valid transport permits from Dinas Kehutanan Riau, the Special Forestry Force (Polisi Khusus Kehutanan) still harassed them and threatened them with arrest on the pretence that the permit had been fraudulently obtained. Village agents who dealt with the police on a regular basis were far more familiar with the process of offering the appropriate bribe in order to get their stocks transported to the market. For small-scale tree growers, the costs of arranging the needed permits and of paying the required bribe tend to be off-putting. This is particularly

so when only small volumes are sold. Clearly the system favours agents who are able to combine lots sold by several tree farmers and thus distribute the cost of obtaining permits. Private tree producers are also subjected to controls on harvesting, transport and sale that the government argues are designed to protect against illegal felling for sale from state forests.

5.3 Matching Decision-Making Theory to Decision Making

The general concern of this thesis is an understanding of farmers' decision-making regarding tree planting. The thesis was prompted by an increased interest in the Indonesian government's efforts to encourage landowners to grow trees on their farms to support the government's plan of creating new resources to ease the wood supply problem in Indonesia. This study has been designed and undertaken specifically to understand and to explain the landowners' or farmers' needs and reasons for tree planting so the government or rural development agencies can intervene to increase their participation in growing trees.

The thesis has addressed this issue by identifying the factors influencing farmers' decision-making regarding tree planting through the hierarchical decision tree modelling, as one of decision-making models in cognitive science. As outlined in Chapter 2, economists have emphasised the importance of economic factors that influence such decision-making and argued that application of economic models are suitable to examine people's decision-making. On the other hand, sociologists and anthropologists argue that examining economic measures to understand farmers' decision-making is not sufficient without considering the importance of non-economic factors. This thesis accepts that economic and social factors are important in farmers' decision-making to plant or not to plant trees.

Farmers' decision-making regarding tree planting has been well studied. However, earlier research tended to present only the main reasons for tree planting decision-making. Instead, all factors that affect decision-making should be examined in detail, and if they were taken together they would provide a comprehensive explanation to develop an understanding of farmers' decision making, not simply a list of factors that influence farmers' decision making. Some studies used indirect approaches or developed induced innovation models in order to understand farmers' decision-making by examining external factors such as increased population, deforestation, increased particular agricultural products, institutional and infrastructure development etc. This type of study successfully identifies significant factors that might influence farmers' decisions to plant more trees on their farm; however, the studies relied on the researchers' points of view and overlooked the reasons used by farmers themselves in making decisions.

Drawing upon a few similar attempts to identify the actual decision criteria and to minimise the researchers' own ethnocentricity, the hierarchical decision tree modelling starts from the assumption that the decision-makers themselves are those who know how they make decisions. Therefore, as outlined in Chapter 3, this thesis started by building the decision tree model as introduced by Gladwin (1989). The use of in-depth interviews was appropriate to subsistence farmers who are found in the case study area.

This research argues that the farmers did not make a complicated calculation in considering options. Different from other studies that presented one factor as the most important or more significant than other factors in motivating farmers to plant trees, this thesis found that both economic and social factors are very important in the process of decision-making regarding tree planting. Farmers do not need to rank which factor is more important than the others when they decide to plant or not to plant trees. Therefore, in examining farmer decision-making it is not adequate to give attention only to the significant factors, ignoring the other factors. The main point is that farmers do not make holistic assignments of utility to each alternative, separately formulate subjective probability for each alternative, and pick the alternative with the most expected utility. Instead, they simply compare alternatives in one dimension at a time. Hence, decision-making is not well represented by traditional quantitative decision models such as linear additive models, or linear programming models. Decision-makers do not assign weights to several variables and then add them up to determine which of several outcomes is better.

This thesis also found that farmers use combinations of economic and social factors in their decision-making to plant or not to plant trees. It can be complicated or almost impossible to quantify all the variables as required by economic models. For example, farmers inside government projects would still plant trees although they were not interested in the incentives provided, but their sense of solidarity and loyalty to their farmer groups would make them plant trees. Landowners outside tree-planting projects would not plant trees if they did not consider that trees require only low costs to establish, less labour to maintain than other crops, and are marketable, although they need to grow anything on their land to avoid squatters. Likewise, the decision tree model formulated in this thesis also showed contrasts where the non-tree planters had their own combination of reasons for rejecting tree planting. The contrasts as depicted in the model can be used to easily understand why farmers planted trees and why some of them did not. These are crucial as the basis to develop an understanding of farmers' decision-making regarding tree planting as stated in the research objective. In addition, quantitative models are not usually tested against a set of choice data to see how well they predict the choices of individuals in a group. This thesis has done such testing. Thus, the model used in this study has

more advantages in understanding farmers' decision-making compared with other methods that only produce lists of decisive factors that motivated farmers to plant trees.

The use of a combination of qualitative and quantitative methods has also increased our understanding of farmers' decision-making regarding tree planting. The survey-based approach followed by statistical analysis was used to indirectly test the cognitive-based model. The quantitative method supplemented and confirmed the findings from the hierarchical decision tree model (HDM). The quantitative analysis assisted the HDM by providing additional insight into decision making. The use of a quantitative approach in strengthening the HDM used in this research also extends Gladwin's (1989) ethnographic decision tree model, since the use of this model typically is associated with the use of a qualitative approach (Gladwin, 1975; Gladwin, 1976; Barlett, 1977; Quinn, 1978; Young, 1981; Gladwin and Butler, 1984; Fairweather, 1996). However, the disadvantage of using a combination of qualitative and quantitative methods is the high amount of time and money that this research has spent.

Indonesian literature shows that there are few studies about important factors that encourage farmers to plant trees. Poel and Dijk (1987) conducted a survey and collected households' characteristics (access to land, labour, capital and off-farm activities, income). They suggested that land use patterns and strategies of households towards tree growing in Central Java appeared to be chiefly determined by a household's access to land and market opportunities. Filius (1997) identified factors that influenced the expansion of trees in the farming system in the Gunung Kidul district of Java. The trend was explained with elements of the induced innovation model of agricultural development; that is, resource endowment, demand for products and institutional aspects, declining soil productivity, an increase in the productivity of staple crops, the Indonesian government's trade and pricing policy for certain tree products, and improved infrastructure. Potter and Lee (1998) carried out rapid rural appraisal (RRA) with stakeholders in oil palm estates, industrial forest plantations and smallholders in West Kalimantan, Jambi and Southeast Sulawesi. They identified that land and market availability are regarded as the main constraints against the expansion of community forests in those provinces.

The above Indonesian research (Poel and Dijk, 1987; Potter and Lee 1998) is typical of studies that highlight the main factors influencing farmers' decision-making to plant trees. Less frequently mentioned reasons that may be decisive factors for some farmers, tend to be overlooked when attention is given to the most frequent reasons. Further, the reasons given importance in a group discussion by farmers may not be used as actual decision criteria. Their responses may reflect what seems most rational after a decision has been made. Filius (1997) used external factors to examine farmers' decision-making to plant trees; however, his study

still needs to examine in detail the actual reasons used by the farmers in tree planting in order to understand their decision-making.

This thesis used Riau province as the case study area, which has distinct social, economic, cultural and political characteristics compared to other provinces in Indonesia. The results presented in this study show variations of decision making in different groups of tree planters: under government supervision, self-motivated tree planters, and under the partnership system. With the advantage of the decision tree model, this research not only emphasises motivations or factors influencing tree-planting decision making but it has also analysed in detail the decision making process itself that needs to be attended to before decision-making is fully understood. Therefore, this research is able to present a new understanding of decision-making with regard to tree growing in Indonesia.

The hierarchical decision tree model (HDM) developed in this thesis represents group decision-making, not individual decision-making. It works because individuals in the same culture do share knowledge in at least some of their decision criteria. Of much use to the policy maker is the generalisation of many individuals' decision criteria into a model for the group. Therefore, HDM can be used for an applied purpose that is important for policy makers, as is shown in the next section. By identifying the decision criteria used by most of the individuals in a group, policy makers can intervene in the decision process with new policies designed to make things better for the targeted group. Helping policy makers is only one of three ways the HDM can be useful. As Gladwin (1989) argued, this testable model of the real-world decision process also provides social scientists with feedback about theories of decision-making. Finally, this decision-making model can also provide valuable feedback to foresters and project planners about why an applied forestry programme aimed at helping some target groups to do something is not going as expected. The HDM can help to recognise people's cognitive strategies and the decision criteria before the project planners try to improve on it. Another important thing stemming from the results is the reliability and suitability of the decision tree model to examine decision-making in the world with diverse discipline.

5.4 Policy Review and Recommendations

This section discusses the research implications for Indonesian government policies identified as relevant to promoting tree planting on private land. The discussion begins with the existing policy that this research criticises because it has put more emphasis on production than on marketing. The result has been a lack of long-term vision in the implementation of tree planting programmes. The production side includes the policies on providing incentives for tree planters such as soft loans. The discussion also suggests how the Indonesian Ministry of Forestry (MoF) could improve its extension agents to keep up with the needs of tree-planting activities, and finally this section highlights how decentralisation in forest management could create a conducive environment to community forestry.

As stated in the long-term plan document in 1997, the MoF has a task to promote and to empower community forests throughout Indonesia to enable them to provide part of the wood supply for mills while also generating income for the participants. Learning from the results, this research suggests that in order to have a successful tree-growing campaign, the MoF should move away from the traditional approach that gives attention only to the biological aspects. The traditional approach was valid when the MoF had to deal with farmers who were paid to reforest the state lands. But community forestry is concerned with tree-planting activities on private land and landowners reserve the right to reject it if they do not see any good in it for them. The results of this research show that the issues of community forestry in Riau are more concerned with social and economic problems than with biological aspects. Some project activities are no longer necessary, such as package training to plant or to maintain trees. Instead the research found that marketing strategy involving community forestry products should be part of the project design. With respect to marketing issues, the research found that it was only tree planters under the partnership system who said that marketing trees was easy. Therefore, the partnership system is a good way to develop mutual co-operation between tree farmers as the producers and timber companies as the buyers, although further attention is needed to improve its management.

Perceiving that landowners need capital to grow trees, the government has put emphasis on trees' establishment by providing tree seedlings, planting wage, fertilisers and weed killers as they did with other programmes. Barlow and Tomich (1991) shared this view by concluding that attempts to intensify smallholder tree planting in Indonesia have been limited by a shortage of funds and technical expertise. Literature in Chapter 2 suggests that to some extent the government policy, in terms of providing incentives, could motivate farmers to plant trees on their farms (Burch and Parker, 1992; Hyman, 1993; Ligon and Narain, 1999). This research

argues, however, that encouraging tree growing by providing incentives only is not enough. After the trees had been growing for about a year, when farmers were no longer able to practise inter-cropping, the trees were left untended. It is suggested also that the MoF should change the way it evaluates project achievement to ensure that incentives really contribute to a successful tree plantation. The MoF assessed the tree planting project achievement by acknowledging the number of hectares of trees that had been planted, and the funding spent on the project incentives. The research found that tree planters would stop tending the trees when they were no longer able to use the incentives. Subsistence farmers plant and look after the trees just for cash incentives and the opportunity to grow food crops among the trees. Therefore, tree-planting project evaluation should take into account the growth of tree plantations that had been funded the year before. This research is not against project incentives since the results show that they motivated subsistence farmers to plant trees. However, they were planting trees just for the incentives not for future market value. Therefore, the incentives should be directed to encourage tree planters to maintain and to manage their trees as well. Soft loans for tree planters, which this research found did not attract tree planter to plant trees, could also be used as an incentive to assist farmers in the phase of maintaining the trees. Free seedlings, cash incentives and soft loan scheme still need to be sustained but by targeting landowners who are able to present evidence that they can grow and maintain the trees in an appropriate manner.

This research argues that the tree planting programme for the subsistence farmers in Kampar region would be successful if treated as additional to other activities such as off-farm jobs or managing rubber trees rather than substituting for them. Trees should be integrated into the farming system and the inter-cropping system should be retained to allow for increased tree crop production without significant reduction in food production, which helps to protect household food security. The research also found that landowners had additional needs and expectations when it comes to tree growing. Landowners planted trees not because they had an interest in managing a woodlot. They planted trees to gain access to government idle land for subsistence needs such as growing food crops. The government could grant usufruct rights to villages or communities or co-operatives to manage government idle lands or unproductive sites as long as they use the granted lands to grow trees along with other food crops on a communal basis. Research in Africa and other Asian countries (Poffenberger, 1994; Shepherd et al., 1995; Sarin, 1996; Korten et al., 1998) shows that improving the land tenure security of forest villages can result in increased community participation in forest management, greater long-term productivity, and reduced administrative costs.

Introducing fast-growing species such as sengon (*Paracerianthes falcataria*), acacia (*Acacia macrophylla*), and suren (*Toona surensis*) are appropriate since they maintain the low-cost of entry and there is a short waiting period until cash returns begin. However, channels to market these species should be created. Channels should provide access to markets for small-scale tree farmers, and costs associated with the practice should be low. Research in Western Kenya and Uttar Pradesh (Deweese and Saxena, 1997; Scherr, 1997) showed that growing trees is likely to be an option if households have access to low-cost tree markets or market channels that serve small-scale producers. Certainly a political will is needed in order to persuade wood-processing companies to purchase some of their supply from the community forests.

Blair and Olpadwala (1988) defined 'political will' as a direct function of the political, social and economic power structure in a country, and it follows the lines of force created by the distribution of power. It is for this reason that the 'political will' like giving a soft loan to logging companies for industrial forest plantation (HTI) establishment was found easy, while the will to guarantee timber market for poor tree planters was so hard to find. Another important thing that could be done to support tree planting would be to remove any institutional blockages, such as the MoF's rules requiring field checks and tree inventories, and taxes for sale and transporting trees from private lands.

This research also suggests that the MoF should improve the way it trains and prepares extension agents. The forestry extension workers in Riau have traditionally served to protect forests. Now they find themselves called upon to become extension agencies facilitating forestry involvement from the same people that they had earlier been trying to keep separated from the trees. The forestry extension workers should be trained like salesman since the research observed that they had to struggle hard to develop a story of the benefits of trees. Their tasks will have to shift from finding suitable project locations, to persuading people to plant trees. Logically, in order to guarantee the project gets continued support, the participants should know exactly why and what they are doing since growing trees involves long-term work. The MoF should introduce social development skills, tree plantation management and marketing knowledge to increase the capability of forestry extension workers or anyone who is involved with community forestry projects in Indonesia. The forestry extension workers in Kampar region have in recent years been active in supporting tree-planting programmes on state-owned lands. It should therefore not be surprising if there was only little experience, or knowledge about tree management. Peluso (1992) observed that in Java, the forestry extension workers who have traditionally served to protect forests now find themselves called upon to become agencies persuading involvement to the same people that they had earlier been trying to keep away from the trees. Those who were policemen are now expected to become salesmen. This

problem has become a familiar one to forestry in many parts of the world and it does affect the performance of the extension workers (Falconer, 1987; Sood, 1996; Warner, 1997).

The forestry extension workers should change the way they persuade farmers to grow trees. They could start by sharing the knowledge of tree growing with small but progressive farmer groups. When they become successful tree-farmers, the other farmers will follow their activities. Gautam (1997) showed this snow balling effect of extension significantly contributed to community forestry development in Nepal.

The role of Jakarta in determining forestry project finance is very important. Aside from the lack of personnel who have sufficient knowledge about community forestry, like other Regional Forestry Offices in Indonesia, the Riau Regional Forestry Office has only a little to say about what is suitable or feasible for community forestry development in Riau province. To comply with the national budgeting regulation, and the forestry national development plan, Jakarta applies a budgeting policy that requires uniformity of activities throughout provinces in Indonesia ignoring the reality, characteristics, and potential of each province. The decentralisation process, which followed the first-ever democratic government in Indonesia after the Soeharto resignation, will give good opportunities for Riau province to develop community-based forest management consistent with its potential problems and strength. This new government system in Indonesia should be regarded as an opportunity for Riau authority to empower its provincial and regional capacities to manage its forest in a more sustainable manner. This empowerment should include creating new policies that are more appropriate in encouraging landowners to participate in community forestry. The urgency of creating new policies on Riau community forestry development has emerged from the results of this study, which showed that the needs and aspirations of the tree-planting participants are quite variable.

Decentralisation also permits the maximum flexibility of the Riau authority in dealing with local peculiarities of the resources, cultural and socio-economic environment during the implementation of the community forestry programme without too much interference from the central government. The decentralisation system in Indonesia forestry has yet to be proven but has great potential to address the specific problems and challenges in Riau province.

The important point that emerges from the results is that the process of decision-making can be documented, and this documentation is useful in assisting the Government of Indonesia as well as aid agencies to promote community forestry in Indonesia. Community forestry projects in Riau may fail in the long run if the designers fail to understand the nature (or even the existence) of the decision-making processes in which they plan to be involved. The tree planters have their own needs and these may be quite different from the government assumptions.

In addition to the implications for government policy promoting community forestry development in Riau province, some aspects of this thesis can be discussed for future research.

5.3 Limitations and Implication for Future Research

This section discusses the limitations of this study, and makes suggestions for future research. The main limitation is because time and place limit the decision tree model. Other limitations derived from the difficulties for the researcher as an outsider in getting a full explanation from the subjects, and observing the role of women in the decision-making process.

One of limitations of this type of research as recognised by Gladwin (1989), and Franzel (1995) is that the hierarchical decision tree model (HDM) is valid only for a certain place and in a certain time. The HDM in this research was formulated by using a sample in the Kampar region. The model was able to show the reasons and constraints of decision making for tree planting in the Kampar region. The Kampar region is not representative of Riau province, so the model is directly relevant only to this region, although Kampar represents the largest region in Riau province where we can find all types of community forestry. Indirectly, however, the results of this study indicate the important elements of decision-making which are likely to occur for farmers in other regions. Therefore, research in other regions would be needed to check and adjust the model.

The interview setting also created a limitation. Most of the respondents (72%) were farmers who were occupied by farming and other activities, especially during the daytime and hence were not prepared to spend much time being interviewed. Efforts to interview the respondents in the evening meant neighbours who also spontaneously answered the researcher's questions accompanied them. The curiosity of villagers in the study area attracted them to gather in the interview setting. The neighbours' responses may have affected the respondents' views. For future research, the solution for this problem will be to stay with the respondent in his/her home to ensure more time is spent with the subject. Future research could also examine how and to

what extent neighbours influenced decision-making. The suggested approach would result in the smaller sample size but it would be a better ethnographic method.

The decision tree model formulation was based on interviews conducted in 1997. Later the model was tested for its reliability in 1999. It is possible that some respondents used in the model testing period may have had a problem in recalling the past experience due to the failure to remember clearly the reasons they decided to plant trees as well as the constraints of why they did not plant trees. So they gave answers that seem rational according to the prevailing situation. If the model testing were quicker, the results might be better. Therefore, it is recommended that model testing should be carried out immediately after the model formulation.

This study also did not focus on the role of women (wives) or other family members that affect men's decision to plant trees. The quantitative data suggested that the male heads of households regarded the spouse's influence as important when they were making decisions to plant trees. Tradition and culture in Riau province does not allow women especially in the rural areas, to speak to male outsiders. The researcher was able to interview a few women respondents, but most of them were absentee landowners who lived in the urban areas and were influenced by city life. Chambers (1983) and Blair and Olpadwala (1988); Sotelo (1999) agreed that in many social and cultural situations, women are not accustomed to interacting with "outsider" men. As a result, communication suffers both ways, so that potential information is lost. Leith and Cummings (1993) who evaluated the role of women in a social forestry project in South Sulawesi, Indonesia found that they participated in design and intent, although they were hardly acknowledged by project management. Therefore, a better approach is needed to give more opportunity for women to express their role in tree planting decisions. The researcher learned that by using traditional language during face-to-face interviewing he was able to create a more relaxed environment that consequently encouraged rural women respondents to explain to the researcher their points-of-view about tree planting. The researcher also found that in Riau, women respondents were cooperative if they were interviewed in their home in the presence of their husbands and children rather than while they were working on the farm.

This research also overlooked the division between farmers who were members of farmers' groups and those who were not. The decision tree model shows that being a member of any farmers' group influenced the landowner in the decision-making process. Therefore, research is needed to examine how membership influences farmers' decision-making. The lists of members of farmer groups can be obtained under permission from the head of each farmer group.

Another aspect that might influence the decision-making process that could be examined is disposable income (Arnold, 1997). Disposable income is that part of the income after farmers have met all their expenses including saving. The decision tree model formulated in this research clearly specifies that income has influenced farmers' decision-making but it did not examine to what extent the disposable income influenced the decision-making. This study did not ask the respondents' disposable income since the respondents used in piloting the questionnaire rejected it and complained that it was too hard and takes time to calculate. With an improved technique of interview and questionnaire, farmers' disposable income can be identified.

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APPENDIX: QUESTIONNAIRE

For Tree Planters

Section a.

1. What is your total land area? _____ ha
- a. What is your total land area planted with rubber trees? _____ ha
- b. What is your total land area planted with trees? _____ ha
- c. What is your total land area planted with others? _____ ha
- (Please mention what they are _____)
2. What is the approximate distance of your tree plantation from your home (minutes or hours), and how do you get there?

3. Did you plant the trees on your idle lands? ☐ Yes ☐ No
4. When did you plant the trees? _____
5. When you planted the trees, did you still need rubber trees? ☐ Yes ☐ No
6. Did you have any experience with elephant damage before you planted trees? ☐ Yes ☐ No
7. If you say "yes" for above question, please explain briefly how many times, and how big the damage was _____
8. Where did you get the idea of planting tree from? ☐ Forestry Extension workers
☐ Company extension workers
☐ Neighbours
☐ Head of farmer group
☐ Other specify _____
9. Do you find what he told about trees worthwhile? ☐ Yes ☐ No
10. Is your tree plantation situated in the tree-planting project either supervised by government or by private company? ☐ Yes ☐ No
- If you say yes please answer question 12
11. If you say no for the question 10, is your land situated in any planting scheme such as oil-palm project? ☐ Yes ☐ No
12. Do you have time to get involved with the project, and get the incentives? ☐ Yes ☐ No

13. *If you say no to the above question, did you find the incentives provided by the project make you interested in planting trees?*

☐ Yes ☐ No

14. Please describe the incentives you received from the project

15. *Did you feel uneasy toward your group if you did not plant trees?* ☐ Yes ☐ No

16. *Was there anything worrying you if you did not plant trees?* ☐ Yes ☐ No

17. If you say yes, could you explain what they were?

18. *Did you need something growing on your land as an ownership status, so other people will not use the land without your consent?* ☐ Yes ☐ No

19. *You must be interested in long-term cash return rather than short-term benefit?* ☐ Yes ☐ No

20. *Are you convinced that tree/timber is a profitable land use commodity and give you quickest return compared to rubber trees or oil palm?* ☐ Yes ☐ No

21. *Do you feel secure with the ownership status of land where you grow the trees?* ☐ Yes ☐ No

22. *Have you ever received any claim that the land does not belong to you, or you had any land dispute with other parties?* ☐ Yes ☐ No

23. What do you use as evidence that the land where the trees grow is yours?

24. Do you look after your tree plantation? ☐ Yes ☐ No

25. *When you planted the trees, did you believe that growing trees was cheaper than growing oil-palm?* ☐ Yes ☐ No

26. *Is your tree plantation situated in the area of oil-palm project scheme?* ☐ Yes ☐ No

27. *How did you get the seedlings of your tree?* ☐ Purchase
☐ Free
☐ Other, please specify _____

28. How much did it cost you? _____ Rupiah/seedling

29. *Did you plant the trees by yourself?* ☐ Yes ☐ No

30. *If you say no for the above question, did you have or pay someone to plant the trees for you?* ☐ Yes ☐ No

31. If you had to pay the labour how much does it cost you? Rp/person/Ha

32. Is any cost involved in your tree management? ☐ Yes ☐ No

- If 'yes', please specify, and how much is it? Rp/ha _____

33. Has your family/clan planted trees before? ☐ Yes ☐ No

34. Did you plant any food crop between the trees? ☐ Yes ☐ No

35. Do you find that this opportunity is worthwhile? ☐ Yes ☐ No

36. What did you do with the food-crop harvest ☐ Self-consumed
☐ Sold it

When the time comes to harvest the trees

37. Are you convinced that your tree is easy to sell? ☐ Yes ☐ No

38. Are you convinced that you will make profit from trees? ☐ Yes ☐ No

39. Please specify your reason if you say "no" to the above questions

40. Do you intend to plant them in the future? ☐ Yes ☐ No

41. Please, state briefly your reason.

42. If you have a chance to change your land use, what do you prefer to do, why?

43. Have you heard about soft loan for tree planters? ☐ Yes ☐ No

44. Does the soft loan attract you to plant trees? ☐ Yes ☐ No

45. If you are eligible for the loan, what are you going to do with the money?

46. Your trees are ready to harvest, which of the following procedure do you prefer most:

- a. The buyers come to buy your standing trees although the given price is low.
- b. You take the timber to the mills and get the high price.
- c. The government should be responsible for marketing the timber.

47. What do you think about the procedure for selling timber?

- a. easy
- b. complicated
- c. don't know

Section B:

Please circle your answer, do not circle if you are not too sure with the answer.

48. How do you rate the importance of the following factors in your decision to plant trees?

- | | | |
|---|------------------|--------------------|
| (a) <i>Perceived timber market</i> | <i>important</i> | <i>unimportant</i> |
| (b) <i>Elephants' damage</i> | <i>important</i> | <i>unimportant</i> |
| (c) <i>Extension workers' advice</i> | <i>important</i> | <i>unimportant</i> |
| (d) <i>You had time</i> | <i>important</i> | <i>unimportant</i> |
| (e) <i>Incentives (cash, free seedlings, fertiliser, weed-killer etc)</i> | <i>important</i> | <i>unimportant</i> |
| (f) <i>The cash incentive is greater than your-off farm wages.</i> | <i>Important</i> | <i>unimportant</i> |
| (g) <i>Neighbours' influence</i> | <i>important</i> | <i>unimportant</i> |
| (h) <i>Head of farmer group influence</i> | <i>important</i> | <i>unimportant</i> |
| (i) <i>Family's (wife) influence</i> | <i>important</i> | <i>unimportant</i> |
| (j) <i>Solidarity to your group</i> | <i>important</i> | <i>unimportant</i> |
| (k) <i>Inter-cropping/taungya system</i> | <i>important</i> | <i>unimportant</i> |
| (l) <i>Land tenure</i> | <i>important</i> | <i>unimportant</i> |
| (m) <i>Low capital required</i> | <i>important</i> | <i>unimportant</i> |
| (n) <i>Less labour required</i> | <i>important</i> | <i>unimportant</i> |
| (o) <i>Perceived loan for tree planting</i> | <i>important</i> | <i>unimportant</i> |
| (p) <i>Tree for long-term investment</i> | <i>important</i> | <i>unimportant</i> |

49. How would you rate the importance of the following policies to encourage you to plant trees for timber product:

- | | | |
|---|------------------|--------------------|
| (a) <i>Market/buyers should be provided</i> | <i>important</i> | <i>unimportant</i> |
| (b) <i>Loan scheme should be provided</i> | <i>important</i> | <i>unimportant</i> |
| © <i>Cash incentives should be provided</i> | <i>important</i> | <i>unimportant</i> |
| (d) <i>Seedlings should be provided</i> | <i>important</i> | <i>unimportant</i> |
| (e) <i>Food crop seeds should be provided</i> | <i>important</i> | <i>unimportant</i> |
| (f) <i>Easy to sell procedure</i> | <i>important</i> | <i>unimportant</i> |

- | | | |
|--|------------------|--------------------|
| (g) Granted lands by the government
as long as being used to grow trees | <i>important</i> | <i>unimportant</i> |
| (h) Technical assistant should be given | <i>important</i> | <i>unimportant</i> |

The following are the questions concerning the respondent's personal information.

50. Identify yourself as a tree planter under
- ☐ Government project
- ☐ Partner system
- ☐ Self -initiative

The following questions are to obtain information concerning the respondent's income.

51. Do you have domestic animals? ☐ Yes ☐ No
52. If yes, what kind of animal and how many do you have? _____
53. How many additional animals do you have per year? _____
54. What price are they in the market? _____
55. How much money do you get from your land? _____ Rp/month
56. How much money do you get from other source of income? _____ Rp/month

Personal data

57. Sex ☐ Male ☐ Female

58. Your occupation _____

59. What age group do you belong to

- 15 – 20

- ☐ 21 - 30

- 31 - 40

- 41 - 50

- ☐ 51- 60

- ☐
- More than 60

60. What is your highest education

- | | |
|--|-------------------|
| | Elementary School |
| | Secondary School |
| | High School |
| | University |
| | Others _____ |

61. How many dependants do you have? _____ people

62. What ethnicity do you belong to?

- ☐ Malay
☐ Javanese
☐ Batak
☐ Chinese
☐ Others _____

63. What do you use to prove that you are the landowner? _____

Thank you very much for taking the time to fill this questionnaire. This questionnaire survey is part of individual research conducted by Didy Wurjanto, University of Canterbury, New Zealand.

Research use only:

Name of interviewer :

Group of interviewer :

Date of interview :

QUESTIONNAIRE

For Landowner who decided not to plant timber trees.

Section a

1. What is your total land area? _____ ha
 - a. What is your total land area planted with rubber trees? _____ ha
 - b. What is your total land area planted with others? _____ ha
 (Please specify what they are _____)

2. What is the distance of your plantation from your home, and how do you get there?

3. When did you plant your plantation? _____

4. *If you plant rubber trees, it is because you need it or you still need to expand your existing rubber trees plantation.*

☐ Yes
 ☐ No

5. *Do you have idle land?*

☐ Yes
 ☐ No

6. Please explain briefly what you do or what you are going to do with the idle land.

7. *Did you have experience with elephants' damage?*

☐ Yes
 ☐ No

8. *Have forestry extension workers ever visited you?*

☐ Yes
 ☐ No

9. *If 'yes' do you find his advice of growing trees is worthy?*

☐ Yes
 ☐ No

10. If the advice you consider is not worth it, please explain your reason, why?

11. *Do you believe that timber trees are profitable?*

☐ Yes
 ☐ No

12. *Is your land situated in any project scheme?*

☐ Yes
 ☐ No

13. *If 'yes', could you specify what project it is?* _____

14. *Do you feel secure with your land ownership status?*

☐ Yes
 ☐ No

15. *Have you ever received any claim on your land?*

☐ Yes
 ☐ No

16. Is any cost involved in your plantation management?

☐ Yes
 ☐ No

17. If 'yes' how much does it cost? Rp/Ha _____

18. Is this management in line with your culture/habit? ☐ Yes ☐ No
19. Do you have time to work on your land? ☐ Yes ☐ No
20. If you have to pay labour, how much does it cost you? Rp/person/Ha _____
21. Have you heard about soft-loan for individual tree planter? ☐ Yes ☐ No
22. Does it make you interested in planting trees? ☐ Yes ☐ No
23. If you have a chance to change your land use, what do you prefer to do, why?
-

24. Why did you not plant trees as recommended by the government? Please explain your answer.

25. If there is a promising market for timbers, do you intend to plant trees? ☐ Yes ☐ No

26. If your answer is 'no', could you specify your reason?

Section B:

27. The following factors are important in your decision not to plant trees?

- | | | |
|---|-----|----|
| (g) No market for planted trees | Yes | No |
| (h) Does not know how to plant trees | Yes | No |
| (i) No one advised you to plant trees | Yes | No |
| (c) Difficult to obtain tree seedlings | Yes | No |
| (d) Family's (wife) suggestions | Yes | No |
| (e) Trees' long gestation period | Yes | No |
| (f) Trees require high capital | Yes | No |
| (g) Planting trees is time and labour-consuming | Yes | No |
| (h) Do not have idle land to plant trees | Yes | No |
| (i) Trees do not grow well on your farm | Yes | No |

28. How would you rate the importance of the following policies to encourage you to plant trees for timber product:

- | | | |
|--|------------------|--------------------|
| (a) Market/buyers should be provided | <i>important</i> | <i>unimportant</i> |
| (b) Loan scheme should be provided | <i>important</i> | <i>unimportant</i> |
| © Cash incentives should be provided | <i>important</i> | <i>unimportant</i> |
| (d) Seedlings should be provided | <i>important</i> | <i>unimportant</i> |
| (e) Food crop seeds should be provided | <i>important</i> | <i>unimportant</i> |
| (f) Easy to sell procedure | <i>important</i> | <i>unimportant</i> |
| (g) Granted lands by the government
as long as being used to grow trees | <i>important</i> | <i>unimportant</i> |
| (h) Technical assistant should be given | <i>important</i> | <i>unimportant</i> |

The following questions are to obtain information concerning the respondent's income.

29. Do you have domestic animals? ☐ Yes ☐ No
30. If yes, what kind of animal and how many do you have? _____
31. How many additional animals do you have per year? _____
32. What price are they in the market? _____
33. How much money do you get from your land? _____Rp/month
34. How much money do you get from other source of income? _____Rp/month

Personal data

35. Sex ☐ Male ☐ Female

36. Your occupation _____

37. What age group do you belong to

- | | |
|----------------------------------|---------------------------------------|
| <input type="checkbox"/> 15 – 20 | <input type="checkbox"/> 41 - 50 |
| <input type="checkbox"/> 21 – 30 | <input type="checkbox"/> 51- 60 |
| <input type="checkbox"/> 31 - 40 | <input type="checkbox"/> More than 60 |

38. What is your highest education

<input type="checkbox"/>	Elementary School
<input type="checkbox"/>	Secondary School
<input type="checkbox"/>	High School
<input type="checkbox"/>	University
<input type="checkbox"/>	Others _____

39. How many dependants do you have? _____ people

40. What ethnicity do you belong to?

<input type="checkbox"/>	Malay
<input type="checkbox"/>	Javanese
<input type="checkbox"/>	Batak
<input type="checkbox"/>	Chinese
<input type="checkbox"/>	Others _____

41. What do you use to prove that you are the landowner? _____

Thank you very much for taking the time to fill this questionnaire. This questionnaire survey is part of individual research conducted by Didy Wurjanto, University of Canterbury, New Zealand.

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